Inequality within the UK: An economic analysis.

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INEQUALITY WITHIN THE UK: AN ECONOMIC ANALYSIS

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Inequality within the UK: An Economic Analysis (2012)

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Summary

With inequalities in earnings, employment and economic activity widespread throughout the UK, this thesis examines these inequalities and attempts to explain them. Data from the Living in Wales survey and the Annual Population Survey is used to examine the earnings response to unemployment in the UK, with particular attention paid to Wales and its position relative to other UK regions. Strong evidence of a wage curve is found, and this wage curve is tested over the earnings distribution and levels of centralization. The returns to degrees, masters and PhDs are investigated, with a focus on how returns vary over regions. Large differences are found using a national baseline, but these differences are greatly reduced when regional differences are controlled for. The use of quantile regression techniques suggests that the graduate premium varies little over the earnings distribution. The inequalities in earnings, employment and economic activity are broken down into a component of individual characteristics and a component of area effects. It is found that area effects play a small role, with inequalities driven by individual characteristics. These individual effects are also broken down, with occupation identified as the key driver of inequalities.

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Summary

With inequalities in earnings, employment and economic activity widespread throughout the UK, this thesis examines these inequalities and attempts to explain them. Data from the Living in Wales survey and the Annual Population Survey is used to examine the earnings response to unemployment in the UK, with particular attention paid to Wales and its position relative to other UK regions. Strong evidence of a wage curve is found, and this wage curve is tested over the earnings distribution and levels of centralization. The returns to degrees, masters and PhDs are investigated, with a focus on how returns vary over regions. Large differences are found using a national baseline, but these differences are greatly reduced when regional differences are controlled for. The use of quantile regression techniques suggests that the graduate premium varies little over the earnings distribution. The inequalities in earnings, employment and economic activity are broken down into a component of individual characteristics and a component of area effects. It is found that area effects play a small role, with inequalities driven by individual characteristics. These individual effects are also broken down, with occupation identified as the key driver of inequalities.

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Chapter 1

Introduction

1.1 Introduction

Inequality in the UK is widespread, with recent evidence (Taylor, 2006, and Dickey, 2007) suggesting that it continues to increase, with inequalities in earnings and employment leading to differences in quality of life. This thesis explores inequalities in earnings, employment and economic activity across the UK using data from the Annual Population Survey (APS) and the Living in Wales survey.[1]

Previous work (Blackaby and Manning, 1990, and Patacchini and Rice, 2005) has pointed to a North-South divide in earnings in the UK that has resulted in the Northern regions falling behind the Southern regions, although this may be more a difference between the London and South East region and the rest of the UK. In this thesis, attention is paid to Wales' position in relation to other areas of the UK, with the most recent measures showing that earnings, employment rates and activity rates in Wales are below the UK average, with gross value added in Wales being just 74% of the UK figure.[2] This thesis examines the wage response to unemployment, economic inactivity and long term employment, the returns to qualifications and the causes of inequalities (in terms of area effects or individual effects), in an attempt to understand why these inequalities exist. I have set out a series of specific research questions which I endeavour to answer over the course of this thesis:

1. What is the earnings response to unemployment and how does this differ by region, worker groups and across the earnings distribution?
2. Does the use of different levels of unemployment rate aggregation, representing degree of bargaining centralization, affect the earnings response to unemployment?
3. Do claimants exert more downward pressure on earnings than those unemployed but not claiming unemployment benefits?
4. Do the economically inactive and the long-term unemployed place downward

[1] The Living in Wales survey was used initially as the APS was unavailable at the start of this research.
[2] Data from StatsWales.

pressure on earnings?

5. Is variation in earnings, employment and economic activity due more to places or the people living in them?
6. What is the largest cause of variation in earnings, employment and economic activity?
7. Does a graduate premium exist and how does it vary over gender, region, subject area, worker groups and the earnings distribution?
8. What are the returns to specific qualifications?

The methodology used in this thesis will allow me to provide answers to these questions over four empirical chapters and a concluding chapter. Much of the methodology uses an augmented Mincer (1974) human capital earnings function as a starting point. The basic form depicts earnings as a function of years of schooling and experience (although in this thesis the highest qualification held and age are preferred). This basic earnings function can then be manipulated to investigate inequalities via several methods in the upcoming chapters. These approaches tend to build on existing empirical studies, but apply the methodology in different contexts, taking the methodology further than has previously been seen (which is explained in greater detail in each individual chapter). To measure the wage response to unemployment, regional unemployment rates are added (in log form), with the coefficient on the unemployment rate term giving the unemployment elasticity of earnings (this methodology is used in chapters two and three). The effect of economic inactivity on earnings can also be explored in this way. Mincer's specification uses years of schooling, which assumes that the returns to schooling are linear. In this thesis (chapter five), qualifications are used instead of years of schooling, which allows the relationship between earnings and schooling to be non-linear. Using this methodology, the premium paid to qualifications (such as first degrees) can be quantified. By limiting the earnings function to either area effects (place) or individual characteristics (people), the variance in earnings can be decomposed into a component attributable to place and a component attributable to people (chapter four). The flexibility of Mincer's human capital earnings function makes these methodologies possible. It should be noted that a possible consequence of estimating aggregated variables (such as the unemployment rate) upon micro units (such as individual earnings) is that standard errors may be biased downwards resulting in statistical significance being awarded spuriously. This will occur if regression disturbances are correlated within groups (Moulton, 1986).

In chapter two, the earnings response to regional unemployment in Wales is analysed, using the Living in Wales survey. This work builds on the methodology devised by Blackaby and Manning (1987) and Blanchflower and Oswald (1990, 1994) that is known as the wage curve. The wage curve describes the negative relationship between unemployment and wages that means that a worker in a high unemployment area will earn a lower wage than an identical worker in a low unemployment area, all else held constant. Blanchflower and Oswald have stated that it is an empirical law of economics that a doubling of the regional unemployment rate shall cause wages to fall by 10%. Log unemployment rates are entered into the model at unitary authority level, producing unemployment elasticities for Wales that are similar to those suggested by Blanchflower and Oswald and those found in the wider literature. The claimant count rate is also used, producing larger elasticities, suggesting it is those who are unemployed and claiming unemployment benefits that place the greatest downward pressure on wages. The deprivation scores from the Welsh Index of Multiple Deprivation 2005 are entered into the model to control for regional differences. The chapter ends with an investigation of the effects of long term unemployment and inactivity upon wages.

The wage curve specification is expanded in chapter three, taking advantage of the wide controls available in the APS and considering all of Great Britain. In addition, unemployment rates are entered at five levels of aggregation (NUTS 1, NUTS 2, NUTS 3, unitary authority and travel to work area). As a way of controlling for differences between regions, house price data is used, which is found to reduce observed unemployment elasticities substantially. Unemployment elasticities are calculated by region, industry, occupation and qualification level, demonstrating differences across groups in the wage response to unemployment. Wage flexibility is also examined across the earnings distribution.

Regional inequalities in earnings, employment and economic activity are considered in chapter four. Using a methodology based on Gibbons *et al.* (2010), the variance in earnings, employment and economic activity is decomposed into components that can be attributed to area effects (place) and individual characteristics (people), whilst also considering how these effects may be correlated. Labour market areas are created from existing travel to work areas and the effects of rural and urban area definitions are tested. Individual characteristics are found to drive regional inequalities and this effect is further decomposed into the separate components of individual characteristics.

In chapter five, the returns to qualifications are considered, focusing on the premiums paid to first degrees, masters degrees and PhDs. The previous literature has shown returns for women to exceed returns to men, prompting returns to be considered separately by gender in this chapter. Emphasis is placed on how the returns to qualifications differ over UK NUTS 1 regions, an area of research that has received little attention (O'Leary and Sloane, 2011, is one of few papers to examine this). The effects of subject area of degree and class of first degree on the qualifications premium are also considered, along with effects along the earnings distribution, via a quantile regression approach. A sub-regional analysis is included, examining how the graduate premium differs between Wales and the UK as a whole and the differences between smaller areas within Wales. Key findings from all four empirical chapters along with policy implications are drawn together in a sixth concluding chapter.

When carrying out empirical research there are certain processes, some of which are identified by Hamermesh (1999). As this thesis is far more empirical than theoretical, many of these processes have been used. When identifying work areas, I have looked for areas in which I believe I can make a contribution, to add value to the existing literature. This is something I have tried to do by taking the analysis to a deeper level, such as the use of five levels of unemployment rate aggregation in chapter three. After deciding on the area to focus on and deciding on the best methodological approach (through a review of the existing literature), I have then had to decide on the best available data to use. Whilst I am fortunate that the APS is appropriate for the majority of my work, I had an issue as the APS was not available when I started work on chapter two. To solve this issue I used the Living in Wales survey and augmented this with data from the Welsh Index of Multiple Deprivation 2005. After selecting and obtaining the data, it is important to then check there are no mistakes in the data. To check for possible errors I have inspected the descriptive statistics of the variable I was interested in, paying close attention to the maximum and minimum values. Other decisions regarding the data and methodology included whether to split the sample, for example by gender, as the literature on the returns to qualifications and an inspection of the means suggests. Analysis of descriptive statistics may prompt other methodological ideas, such as the use of quantile regression techniques to measure differences in earnings response along the earnings distribution (as seen in chapters three and five). The correct set of explanatory variables must also be selected, so that as much variation as possible in the dependent variable can be controlled for, whilst avoiding the use of any variables that may cause an endogeneity problem.

When analysing results, Hamermesh refers to the "sniff test" which simply means that a researcher should question whether the results are reasonable and make economic sense. Where results may be unexpected I have gone back and checked the methodology and literature and have tried to find the reason for this result. This has proved possible in chapter three, where the 'U' shape in wage flexibility can be linked to a study by Groth and Johansen (2003), but more difficult in chapter two where the effects of economic inactivity on earnings is relatively unexplored. In terms of improving results by tinkering with the methodology, this should only be done as long as the benefits exceed the costs (such as the time taken). Due to the size of the data sets used and the focus on empirical results I have not presented many diagnostic statistics. Results should be included on the basis that they are economically important, not just statistically significant. Also, I only report the full set of results from a basic specification once in each of the empirical chapters, just focusing on the key variables in the majority of results tables. I have presented results in graphical form, where I believe this to be the most useful way of explaining results (for example, the quantile regressions in chapter three). When drawing key findings together into conclusions I have tried to identify a series of policy implications that arise from these key results.

Chapter 2

The Welsh Wage Curve and the Issue of Inactivity

2.1 Introduction

Since the early wage curve studies of Blackaby and Manning (1987) and Blanchflower and Oswald (1990), there has been a plethora of studies further examining the relationship between unemployment and wages, with research pointing to an unemployment elasticity around -.1. This chapter aims to estimate the wage curve for Wales, using data from the Living in Wales survey, and also to investigate the effect of changing the measure of labour market slackness used. Generally, in wage curve studies the unemployment rate is used, but in this chapter the claimant count rate is also used, at both unitary authority and postcode sector levels of disaggregation. These two rates both provide an indication of labour market slackness, but measure it in differing ways (which are discussed later on). It is believed that these measures will produce differing elasticities due to the differences between them. The wage curve is estimated for the whole of the UK (and its constituent countries and regions) in chapter three, with a focus on the use of differing aggregations of the unemployment rate.

Whilst investigating the relationship between unemployment/claimant count rates and earnings, I make use of the Welsh Index of Multiple Deprivation (WIMD). The WIMD gives deprivation scores at Lower Layer Super Output Area (LSOA) level across 7 categories. It is hoped that by entering these individual deprivation scores into my earnings function I will be able to control for differences between localities that are not usually controlled for in many wage curve studies. Use of the WIMD serves a dual purpose, as due to a lack of education data in the Living in Wales survey, the education domain can be used to control for differences in education (the Annual Population Survey, which is used in the remaining empirical chapters, does contain information on respondents' education).

This chapter also attempts to address the issue of inactivity in Wales. Wales' poor economic performance in relation to the rest of the UK is partly driven by its high numbers of economically inactive. These high levels of inactivity may be a reaction to the large scale industrial restructuring that took place, particularly in the 1970s and 1980s, which has left large numbers feeling distant to the labour market. Inactivity in Wales is above the UK average for both men and women, although it is falling for women. Inactivity serves as a cause of hidden unemployment, and I test if those who are inactive exert downward pressure on wages as the literature has shown the unemployed to do. To examine the problem of inactivity, inactivity rates are inserted into the earnings equation, along with separate rates representing those individuals who are inactive, but want to work, and those who are inactive and do not want to work. In addition, I also test the effect of the long term unemployed on wages. Both inactivity and long-term unemployment can be used to measure proximity to the labour market, and the effects on wages as people move further from the labour market.

In section two, an overview of the previous literature regarding the wage curve is provided. Section three is an explanation of the data and methodology used. Section four presents regression results and evaluates their meaning, with conclusions drawn in section five.

2.2 Literature Review

In presenting a review of the literature regarding the wage curve, it is useful to first examine the studies that led to the development of the wage curve methodology. After these early studies, the literature review focuses on studies that use UK and US data and then moves on to international studies.

The relationship between unemployment and wages has been investigated by economists since the early 1970s, with papers by Harris and Todaro (1970) and Hall (1970, 1972) leading the way. Harris and Todaro (1970) base their study on Africa and formulate a two sector model with migration between rural and urban areas. They find that rural workers earn a lower wage, but unemployment in these areas is low. Urban workers, on the other hand, earn higher wages, but have a greater chance of becoming unemployed. This supports the theory of compensating differentials, where to work in a high unemployment area (urban), workers must be compensated with high wages.

Hall (1970, 1972) bases his research on twelve US cities in 1966 and aims to investigate why there is high unemployment at full employment levels. He notes that this may be caused by differences in unemployment over cities, so that whilst the economy is at a point of full employment, some cities are not. Hall recognizes that high wage cities also have high unemployment, and that migration may not occur to smooth out unemployment rates as people are willing to risk unemployment for the chance of higher wages. Employers will be willing to operate in high wage cities because of the increased stability that unemployment causes in their workforce, as workers will not want to quit or change jobs due to the high levels of unemployment, reducing hiring and training costs for the employer.

Reza (1978) expands on Hall's work, using 18 areas (12 of which are based on the cities used by Hall) between 1967 and 1974 to examine the link between unemployment and earnings. Findings again suggest the relationship between the unemployment rate and earnings to be positive, with larger and more robust estimates found using nominal earnings as opposed to real earnings. This study again supports the theory of compensating differentials.

Using data from the Panel Study of Income Dynamics (PSID) between 1970 and 1976, Adams (1985) tests the effects on log hourly wages of using unemployment rates measured at region and industry levels. Regional unemployment rates again display a positive coefficient, suggesting that high unemployment areas will also have high wages. However, industry unemployment rates have a negative effect on wages, suggesting that in industries with high unemployment, downward pressure is placed on wages.

The methodology that would become known as the wage curve was first used by Blackaby and Manning (1987). Their innovation was the inclusion of the log of the regional unemployment rate and microeconomic data on earnings, which when used in an augmented Mincer earnings function gives the unemployment elasticity of earnings. Much of the previous literature regarding the role of unemployment in determining wages originated from the work of Phillips (1958) and the Phillips curve, which relied on the use of macroeconomic data and focused on the effects of the aggregate unemployment rate on the rate of change of wages. In their cross-section analysis, they use data from the General Household Survey from 1975, allowing them to control for schooling, work experience, marriage, industry of employment and the number of weeks worked in the previous year. The log of the unemployment rate is entered at region level. They find the sign on the log of unemployment to be negative, at -.16, which they interpret as the long run unemployment elasticity of earnings. This figure is above the suggested 'averages' that would emerge from Blanchflower and Oswald (1990) and Nijkampf and Poots (2005), but is well within the bounds of the literature. This negative relationship between regional unemployment and earnings does not fit with the theory of compensating differentials; however, as pointed out by Blackaby and Murphy (1991), it does provide support for the efficiency wage (Shapiro and Stiglitz, 1984) and search models of wage determination.

The divide between the prosperous South and depressed North of Great Britain is investigated by Blackaby and Manning (1990), using the General Household Surveys of 1975 and 1982. They estimate an earnings function regressing individual annual earnings on a set of personal characteristics, industry, occupation, regional unemployment (in log form), regional long-term unemployment and regional cost of living differences. An unemployment elasticity of earnings of -.1289 is found in 1975, rising to -.1859 in 1982. When including the proportion of unemployed who have been unemployed for 52 weeks or more, the coefficient is positive, whilst the overall unemployment term remains negative, supporting Layard and Nickell's (1986) theory that the long-term unemployed do not exert downward pressure on wages. Decomposition analysis reveals that, for 1975 data, over 50% of the South

East's advantage is due to characteristics, although by 1982, characteristics are unable to explain as much of the regional difference in earnings.

The idea of the wage curve was further investigated by Blanchflower and Oswald (1990, 1994). Blanchflower and Oswald set out to establish a law of economics concerning the negative effect of local unemployment upon the level of wages. Their 1990 study, which used 4 datasets from the UK and the US, found that there is a non-linear relationship between unemployment and the level of wages, resulting in a wage curve. The wage curve is negative at low levels of unemployment, reflecting the negative low level unemployment elasticity of wages, but will then flatten once unemployment has reached a certain level (found by Blanchflower and Oswald to be between 9 and 15 percent). This horizontal section is reached when the downward pressure of unemployment on wages has reached a maximum. At this point, shocks to the economy would have zero to slight effect on wages, but large effects on unemployment. They noted that the wage curve was found to reach a point where it would become positive, which was not predicted in their theoretical model. They dismiss this as unreliable, due to the small number of observations at such high unemployment rates. Blanchflower and Oswald test different methods of entering the unemployment rate into the model, such as the reciprocal, the square and the cube of the unemployment rate, but note that, partly due to its ease of computation and interpretation, the natural logarithm is their preferred specification. This has led to the natural logarithm becoming the preferred method of entering the unemployment rate across the wage curve literature, although some later studies, such as Johansen (1997), have experimented with alternative methodologies. Blanchflower and Oswald use area unemployment rates for 3 of their 4 datasets and use industry unemployment rates for the remaining dataset, but find the wage curves produced to be very similar. They also include long term unemployment in several specifications, but conclude that due to its weak performance, it has little effect on wage determination. This would imply that the long term and short term unemployed have similar effects on wages, an insight that contrasts with Layard and Nickel (1986) and would be challenged by later studies such as Blackaby, Bladen-Howell and Symons (1991) and Johansen (1997), who suggest the effect of the long-term unemployed is smaller than the short-term employed. Blanchflower and

Oswald present three models to explain the relationship found between unemployment and the wage level: an implicit contracts model, an efficiency wage model and a bargaining model. Blanchflower and Oswald expanded their initial article to a near 400 page book and have revisited the wage curve in several further articles. They have set out an unemployment elasticity of -.1, as an empirical law of the magnitude of the unemployment elasticity of wages.

Blackaby and Murphy (1991) analyse regional wage differentials using data from the New Earnings Survey and the General Household Survey from 1982, with a sample size of 6,999 employees (working over 27 hours per week). Blackaby and Murphy identify large differences in earnings between different industries, highlighting the differences between each group of individual's human capital characteristics. However, after allowing for these characteristics, much variation in earnings within an industry by region still exists. Blackaby and Murphy theorize that (under the competitive theory model) these earnings inequalities may arise as a stage in the adjustment process to a long run wage equilibrium or as compensation for some non-wage attributes. Exploring the latter, they introduce a series of environmental variables designed to reflect quality of life differences between regions, including a series of climate variables and variables representing atmospheric pollution, road congestion and recreational facility provision. This technique is in a similar vein to Roback (1982) and the later study of Srinivasan and Stewart (2004). However, in testing it was found that few of these variables were significant and they were therefore removed from further regressions. Population density was found to be a significant contributor with a positive coefficient. Blackaby and Murphy comment on the strong association between population density and variables representing regional social and environmental deprivations. They also test some firm based variables, looking at firm size, which is found to be insignificant and is therefore removed, and the proportion of employees paid under a payment by result scheme, which is found to be positive and significant. This result implies that employees' effort is increased and rewarded by an increase in wages, compared to those not remunerated by a payment by result scheme. Blackaby and Murphy identify cost of living differences (measured by regional price index) to be highly significant and close to unity. They find the regional unemployment rate to be significant, displaying an unemployment elasticity of approximately -.13, similar to the elasticities found by Blackaby and Manning (1987) and Blanchflower and Oswald (1990). Blackaby and Murphy state that this result provides support for the efficiency wage and search models of wage determination, assuming regional unemployment is a measure of excess demand across regions. As in similar studies, a long term unemployment variable becomes insignificant as further variables are added to the model. Initially, it was found that those individuals in long term unemployment caused a significant and positive effect on wages, with the total unemployment effect remaining negative, as above. They also find a positive and significant relationship between experience (represented as tenure in current job) and wages.

Blackaby, Bladen-Howell and Symons (1991) use a dataset of 25,653 male employees taken from the Family Expenditure Survey between 1980 and 1986 to investigate the role played by the unemployment rate in wage determination. They also consider the role of regional price variation in wage determination. As dependent variable they use real wage, defined as the log of normal hourly wage over the national retail price index. Unemployment is entered at regional level. Controlling for industry and occupation, the regional unemployment rate is found to be significant, with an unemployment elasticity of income of -.1659. Whilst this figure is greater than the unemployment elasticity set out by Blanchflower and Oswald (1990), it is still comparable and is very close to the figure found by Blackaby and Manning (1987). Blackaby, Bladen-Howell and Symons replace the regional unemployment rate with regional prices, finding a coefficient of .72 which confirms the large role played by regional prices in wage determination.

Exploring the effect of duration of unemployment on wage determination, Blackaby, Bladen-Howell and Symons introduce a long term unemployment rate variable[3] into the model, which is found to be positive and significant. This result is said to support Layard and Nickell's (1987) hypothesis that as unemployment duration

3 Where long term unemployment is classed as unemployment in excess of 52 weeks.

increases, the downward pressure on wages will subside, due to the chances of them finding a job getting progressively smaller, increasing the likelihood of them dropping out of the labour market altogether. Also, as regional cost of living is introduced into the model, the t statistics on the unemployment terms shrink, to the point that they are no longer statistically significant.

This work is furthered by Blackaby and Hunt (1992). Focusing on male employees from the 1982 General Household Survey, an augmented Mincer earnings function is set up with regional unemployment rates, regional unemployment duration rates and a regional cost of living index, whilst industry and occupation are controlled for.[4] Initially, Blackaby and Hunt present the results of specifications similar to previous studies, including Blanchflower and Oswald's wage curve. Their initial wage curve based specification produces results in line with Blanchflower and Oswald (1990), but by augmenting the wage curve, results differ from Blanchflower and Oswald (such as the inclusion of long term unemployment, which is positive and significant, and the long term unemployment rate squared, which is negative and significant). This leads Blackaby and Hunt to state that the long term unemployed do have a different effect on wages compared to the short term unemployed. The positive effect of the long-term unemployed on wages was also found in the previous studies of Blackaby and Murphy (1990) and Blackaby, Bladen-Howell and Symons (1991). Blackaby and Hunt go on to derive and test several further models. Blackaby and Hunt test whether the non-linear terms may be omitted, however, this specification is rejected by F-test. A specification is tested with all long term variables removed, the results of which allow Blackaby and Hunt to conclude that long term unemployment has no effect on wage determination and that the wage curve is a wage curve for short term unemployment and not total unemployment. Blackaby and Hunt are also able to put forth a theory as to why the wage curve becomes positive at high levels of unemployment: that it is an amalgamation of the wage equation and the migration equilibrium condition, which have opposite slopes.

4 Blackaby and Hunt have divided the data into 19 regions, based on CSO regions.

Card (1995), has produced a review of the work of Blanchard and Oswald (1994). Card questions whether the wage curve is a completely new economic theory, comparing Blanchflower and Oswald's specifications and results to earlier studies (such as Bils 1985, Solon, Barsky & Parker 1994, Bartik 1991 and Blanchard & Katz 1992), but does find the wage curve to produce new findings regarding the cyclicality of real wages. Card questions whether Blanchflower and Oswald's use of annual earnings (particularly amongst their U.S. studies) has resulted in them discovering an "hours curve" as opposed to a wage curve. Blanchflower and Oswald claim wage curve elasticity to be the same for hourly, weekly and annual earnings, but Card is able to show this conclusion to be flawed. However, Black and FitzRoy (2000) later advocate the use of annual earnings in a wage curve setting, due to it encompassing overtime effects. Card finds differences in the elasticity across groups, with elasticity greater for men than for women, for those less educated, for those younger, for non-union members and for those in the private sector, conclusions which have been supported by numerous later wage curve studies.

Turunen (1998) presents his research on the wage curve disaggregated over time. He suggests that wage curves will vary over time and different labour market groups due to characteristic differences, differently influencing the effect of unemployment on wages. This variance is explained as being primarily due to differing responsiveness to local labour market conditions, with groups that are more highly vulnerable to outside labour market effects (such as the younger and less educated) having the largest unemployment elasticities. Turunen utilizes data taken from the National Longitudinal Survey of Youth over the period 1979 to 1992,[5] with 9,929 individuals included. Turunen estimates the wage curve via an augmented Mincer earnings function, with the log of real wages regressed on the log local unemployment rate along with controls for region, year and individual characteristics. Disaggregating by year, Turunen finds a wage curve for all years except 1980 (1979 with region controls omitted), with the unemployment elasticities growing larger and more

5 The NLSY is a longitudinal study of 14 to 22 year olds, interviewed in each subsequent year regarding their labour market experiences. It should be noted that there is oversampling of the economically disadvantaged, such as blacks, Hispanics and other ethnic minorities.

significant as the period progresses. The explanation offered, drawing on Blanchflower and Oswald (1995), is that the 1980s were characterised by relatively high, but declining unemployment rates, which would greatly affect young workers (who are generally found to be at a labour market disadvantage relative to other age groups), resulting in unemployment elasticity for the young rising throughout the 1980s.[6]

Turunen next calculates the wage curve after disaggregating by different worker characteristics using an individual fixed effects method suggested by Card (1995). It is found that the individual fixed effects controls or region controls are not required to observe a wage curve. Amongst his findings are that the earnings of men are more dependent on the local unemployment rate than women, particularly at higher unemployment rates. The greater the educational attainment, the less elastic an individual's wages will be to local unemployment rates, with the most educated experiencing an extremely shallow, almost flat, wage curve. Government workers experience very small unemployment elasticity, seemingly almost unaffected by local unemployment rates, perhaps due to centralised wage setting, as suggested by Katz and Kruegar (1991). Turunen's results pertaining to race suggest conflict with earlier studies. In contrast to Freeman (1990), Turunen finds that young black workers' wages are slightly less sensitive to local labour market conditions than young white workers. Hispanics are found to be greatly affected by local labour market conditions, with an unemployment elasticity of 17.2% (with no fixed effects). Also, in comparison to those living in rural areas, the wages of those living in urban areas are far more sensitive to the local unemployment rate. Disaggregating by occupation, Turunen finds the largest unemployment elasticities to belong to sales persons, craftsmen and labourers, whilst professionals and service workers appear to have the most labour market protection. Turunen cites Freeman and Katz's (1995) explanation that low skill occupations suffer greater unemployment than high skill occupations, which coupled with the high unemployment rates in 1980s USA, give the high unemployment elasticities experienced by these low skill occupation

6 Turunen notes that due to high year-to-year variance in unemployment elasticities, the results and corresponding explanation should be cautiously interpreted.

groups. When disaggregating by industry, wage curves are found for all groups, except mining, which displays a positive and significant coefficient.[7] Service industries are found to have large unemployment elasticities relative to traditional industries. Turunen suggests the reason for this may be that monitoring is easier in the traditional industries, therefore resulting in less need for incentive wages. Finally, Turunen calculates wage curves by region, finding most regions to have a wage curve, but significant variation in unemployment elasticities. Turunen concludes that by disaggregating by year, characteristics, industry, occupation and region, he has found many wage curves, and that the aggregate wage curve is made up of these disaggregated wage curves, accounting for the volatility in the aggregate wage curve.

Using county level data on full time male manual workers over the period 1979 to 1995 from the New Earnings Survey, Black and FitzRoy (2000) evaluate the relationship between unemployment and earnings and examine the role played by hours worked. Black and FitzRoy claim that due to overtime being paid at a premium, average hourly earnings are insufficient for investigating the wage curve relationship. As overtime is utilized in response to demand shocks, it will vary over time, although there may be a cyclical effect, perhaps with overtime occurring more regularly during the Christmas period prompting them to suggest using total earnings in the wage curve relationship instead.[8] They claim that the rapid response of total earnings through overtime hours suggests a wage curve, whilst the slower response of standard hourly earnings was more in line with a modified Phillips curve. Using Card and Hyslop's (1996) test of the wage curve based on the rate of change of wages, they find support for the wage curve from both average hourly earnings and total earnings. They initially find an unemployment elasticity of income of -.02, smaller than Blanchflower and Oswald's suggested figure of -.1. This would seem to be at odds with Nijkamp and Poot's (2005) analysis which suggested that

7 Perhaps this result may be the result of a small sample, only 593.
8 The Levin and Lin (1993) panel unit root test is used to test the suitability of total earnings and average hourly earnings.

unemployment elasticity is greater when using annual earnings data compared to average hourly earnings (-.1365 to -.0628).

Black and FitzRoy regress the log of total hours on the log of unemployment and the change in the log of unemployment, with the results revealing that hours worked are affected by the change in unemployment, but not the level of unemployment, supporting Black and FitzRoy's previously mentioned theory that overtime is a short run response to demand shocks. They also construct a panel estimation with two lags of total earnings and a differenced specification to investigate short run dynamics (with detrended total earnings and differenced total earnings as the dependant variable). They find that when lagged total earnings are tested there is great dependence on the change in unemployment. Concerning the differenced specification with total earnings, the level of unemployment is found to be insignificant (whilst the change in unemployment is highly significant), which is in line with Blanchflower and Oswald's theory about the Phillips curve's irrelevance. When replacing detrended total earnings with detrended average hourly wages, the effect of the change in unemployment is insignificant, resulting in a wage curve with long run unemployment elasticity of .07. With differenced average hourly earnings, level of unemployment reveals a strong negative coefficient, which is in support of the Phillips curve, in conflict to Blanchflower and Oswald's claims. Black and FitzRoy conclude by stating their results provide microeconomic support for the New Keynesian macroeconomics of sticky wages.

The British Household Panel Survey (BHPS) between 1991 and 1998 is used by Collier (2000) to estimate the UK wage curve. He uses the log of real hourly earnings and is able to control for a wide range of personal and job characteristics including gender, ethnicity, marital status, qualifications, children, age, health, recent labour market history, union membership, full time/part time status, promotion opportunities, management duties, supervisory tasks, industry, occupation, work travel time and region. From a semi-log function, Collier estimates a male unemployment elasticity of -.14. Switching to a log-log function, the unemployment elasticity drops to -.05, a result he notes to be surprising. The semi-log specification is Collier's preferred specification, as it is less restrictive than the log-log specification. A J-test confirms the choice of a semi-log for Collier's data. Results for women reveal there to be no significant wage curve for the female sample, a result previously found by Janssens and Konings (1998) and Pannenberg and Schwarze (1998). Collier adds regional fixed effects to his specification for men, finding the magnitude of the unemployment elasticity to be reduced. Collier also tests using monthly earnings instead of hourly earnings and finds very little difference in the elasticity of earnings.

Bell *et al*. (2002) use the New Earnings Survey (NES) covering the years 1976-1997 to examine whether regional wages depend solely on regional unemployment or also on aggregate unemployment, and whether the wage equation is a relationship between unemployment and the wage level or wage changes, amongst other questions. Data is broken down to 10 regions across Britain. The dependent variable chosen is average hourly wage, specifically to avoid overtime effects due to their link with the business cycle. In the absence of information on qualifications or schooling, human capital is represented by four skill groups based on the occupation an individual is employed in. The Living in Wales survey also lacks qualification data, which prompts us to test Bell *et al.*'s method in this chapter. They find no evidence to suggest that regional wages are dependent on aggregate unemployment (although they are dependent on regional unemployment, thus maintaining the wage curve relationship) and also reject that the wage equation is a relationship between unemployment and wage changes (which, if true, would imply a Phillips curve, as opposed to a wage curve). Bell, *et al.* finds the short-run unemployment elasticity of wages to be -.034 and the long-run unemployment elasticity of wages to be -.13. They also find, by disaggregating by gender, that the wages of males are slightly more sensitive than the wages of women.

Johnes (2007) uses the British Household Panel Survey (BHPS) between 1992 and 2003 to test the relationship between regional unemployment and hourly wages. The use of a panel dataset allows for control of individual fixed effects, alongside gender, age, age squared, marital status, dependent children, health, union membership, and qualifications. An unemployment elasticity of -.048 is initially found. The addition of regional indicator variables reduces the coefficient to -.035, whilst the addition of controls for industry and occupation further reduce the elasticity to -.023. Interactions between years, gender, degree level qualifications and the unemployment rate reveal that the magnitude of the male wage premium fell to .097 by 2003 (from .148 in 1992), whilst over the sample period the graduate premium declined from .308 to .260. The unemployment elasticity is unstable over 1992 to 2003, peaking at -.074 in 1995 and falling to -.032 in 2003. Testing for endogeneity by instrumenting with the lag of unemployment increases the magnitude of the unemployment elasticity coefficient. The difference between using random effects and fixed effects is very small (-.032 to -.034).

Nijkamp and Poot (2005) present a meta analysis on 208 unemployment elasticities reported in 17 previous wage curve studies, with the aim of explaining why differences exist. Nijkamp and Poot estimate that, as of 2005, close to 1000 estimates of the unemployment elasticity of wages exist. They report a minimum unemployment elasticity of wages of -1.43 and a maximum of .09 in their sample, with a mean of -.1184, close to Blanchflower and Oswald's figure of -.1. Nijkamp and Poot are able to answer Card's concern that the wage curve is partly affected by how working hours vary with business cycles, as the wage curve is more elastic in annual earnings equations compared to hourly earnings equations (-.1365 to -.0628). Nijkamp and Poot question whether wage curve estimates may be affected by publication bias and find there to be publication bias where too many equations with significant unemployment effects are reported. After controlling for this publication bias, they find their mean unemployment elasticity of wages falls to -.07.

There is also much international wage curve research conducted upon countries with economies of varying similarity to the UK. A selection of this international literature is examined in the remainder of this literature review.

Long-term unemployment, convexity and kinks in the Norwegian wage curve are examined by Johansen (1997) via an error correction model. Testing for non-linearities in unemployment, Johansen enters the unemployment rate in several forms. The logarithm of unemployment gives an elasticity of -.07. Various other figures are obtained using the square, the cube and the reciprocal of unemployment, methods previously tested by Blanchflower and Oswald (1990, 1994). Using a piecewise regression model, a kink in the wage curve is found at an unemployment rate of 1.4%, with responsiveness differing above and below this point in the unemployment distribution. An elasticity of -.16 is found for unemployment rates greater than 1.4%, and -.035 for unemployment rates greater than 1.4%. Johansen suggests that the difference in these results may be caused by different wage formation mechanisms operating at low and high levels of unemployment. The effect of the long term unemployed is tested via the inclusion of unemployed who have been unemployed for 26 weeks of more. The coefficient on the proportion of long term unemployment is significant and positive, meaning that the long term unemployed place less downward pressure on wages than those who have been unemployed less than 26 weeks. They find no support for including the long term proportion of unemployed non-linearly.

Pannenberg and Schwarze (1998) calculate the wage curve of East Germany and question whether the unemployment rate is sufficient as a measure of labour market slack for countries with large scale labour market programs. Pannenberg and Schwarze's concern is whether countries operating an active labour market policy (ALMP[9]) will have accurate unemployment rates, as those participating in ALMP schemes would not be counted as unemployed. Using data from the German Socio Economic Panel (GSOEP) between 1992 and 1996 they remedy this problem by including in the standard augmented Mincer earnings function that forms the basis of most wage curve studies, the regional ratio of unemployed job searchers and participants in labour market training programs. The dependent variable is the logarithm of the average hourly wage, with standard control variables included. Although a wage curve is found with regional fixed effects (a relatively large

9 To include job creation schemes and training programs.

unemployment elasticity of -.28), the addition of individual fixed effects strip away any evidence of an East German wage curve. Replacing unemployment rate with job searcher rate[10], an inverse relationship is found between job searcher rate and average hourly wages of -.14. A Davidson/MacKinnon J-Test confirms that Pannenberg and Schwarze's extended wage curve is more suitable for East Germany than the standard Blanchflower and Oswald wage curve.

The German wage curve is again examined by Baltagi and Blien (1998) using the Institut fur Arbeitsmarkt und Berufsforschung (IAB) employment dataset between 1981 and 1990, which includes 6590 workers and over 40,000 observations. They enter unemployment rates at a highly disaggregated level, using 142 labour market regions. The wage curve is estimated over subsamples such as age, gender and qualifications. Baltagi and Blien's fixed effects results for qualifications corroborate those found by Blanchflower and Oswald (1994) where less qualified workers have the greater negative unemployment elasticity. Young workers (below 30) are found to have a significant negative unemployment elasticity, whilst the coefficient on workers over the age of 30 is positive (.04). After controlling for gender, coefficients are significant.

Montuenga *et al.* (2003) estimate the wage curves of 5 EU countries: France, Italy, Portugal, Spain and the UK between the years 1994 and 1996. Their aim is to challenge Blanchflower and Oswald's (1994) claim that regardless of the country or period analysed, the empirical law of an unemployment elasticity of -.1 will hold. Data on all countries is taken from the European Community Household Panel. As this dataset is homogeneous, with the same questions asked in all countries, cross country comparisons are possible. The logarithm of the average hourly wage is used as the dependent variable. Montuenga *et al.* find evidence supporting a wage curve in all 5 countries (although, in the case of the UK, the evidence is weak and sensitive to the testing method). In contrast to Blanchflower and Oswald (1994),

10 Job searcher rate is found as the ratio of unemployed and participants in labour market training programs to the total of unemployed, employed and trained.

unemployment elasticity is found to vary across the 5 countries, with France being the most sensitive to unemployment and Portugal the least sensitive.

Wu (2004) attempts to establish a wage curve relationship for China. Due to the system for recording unemployment in China,[11] the main source of unemployment is school leavers in cities. Wu states that over the preceding 20 year period, approximately 70% of the unemployed were aged 16 to 25. Since fewer youths are excluded from the unemployment rate than older individuals, Wu believes the youth unemployment rate to be a better source of data. Sabin (1999) previously attempted to find a wage curve for China using the provincial unemployment rate, however, the analysis failed to find a consistent inverse relationship between provincial wages and the provincial unemployment rate. For this reason, Wu concentrates on the provincial youth unemployment rate, finding an unemployment elasticity of -.22. This figure is relatively high compared to other wage curve studies, but may be explained by the fact it is limited to the youth unemployment rate, with previous studies (such as Card, 1995 and Baltagi *et al.*, 2008) showing younger workers to be more sensitive to unemployment changes.

Berg and Conteras (2004) differentiate their contribution to the literature by studying two very different periods in Chile's history. Between 1957 and 1973, Chile was state-led and operated within a closed economy; however, due to a series of reforms in 1973 liberalizing trade and finance, increasing labour market flexibility and de-politicizing labour relations, the period 1974 to 1996 was characterised as private sector led, within an open economy. Berg and Conteras utilize data from the University of Chile's employment survey. They find an unemployment elasticity of .034 for the whole period and for the 1957-73 period. This positive result is in contrast to most wage curve studies, but may be caused by the labour market environment which existed in Chile during the state-led, closed economy period.

11 The only people classed as unemployed and part of the urban registered unemployment rate are those people registered as permanent residents in urban areas and involved in non-agricultural activities, thereby omitting the entire rural labour force. There are also other categories for the jobless, outside of unemployed, such as laid-off, which compounds the problem.

After the 1973 reforms, unemployment elasticity was found to be -.078, which is in-line with the expected wage curve elasticity of between -.07 and -.1. This means that only after trade and labour reforms did unemployment exert a downward pressure on the wage in Chile.

Berg and Conteras consider the problem outlined by Moulton (1986), whereby regressing a highly disaggregated variable (hourly wage) upon a more aggregated variable (unemployment) results in standard errors that are biased downwards. This causes t statistics to be biased upwards, overstating the significance of coefficients. To counter this problem, they employ a cell means regression. Variables are averaged according to economic sector and time, resulting in 256 cells, containing an average of 572 individuals. Regression is by generalised least squares. As expected, results are very similar to ordinary least squares (OLS) in magnitude, but t statistics are reduced, resulting in the coefficient on unemployment for the pre-reform period becoming insignificant. This supports the initial finding of a wage curve for Chile, occurring only after the 1973 reforms. Regarding disaggregation by worker groups: it is found that women have greater unemployment elasticity than men, a finding that is not shared with many other studies, but is explained in this case due to women being affected more than men by the 1973 reforms, as industries with heavy female employment, such as textiles, saw heavy losses in output and employment. As expected, unskilled workers were found to be more vulnerable to changes in unemployment than skilled workers. When split by private/public sector, both appear positive in the pre-reform period (although only private sector is significant), whilst both are negative after reform. In this post-reform period, the public sector is found to display the higher unemployment elasticity. However, this (unexpected) result may be due to Chile's classification of public sector including workfare recipients. Berg and Conteras are also interested in testing the theory that informal workers act as a buffer during recessions. To do this, they test self-employed workers, but their coefficient on unemployment is found to be insignificant, refuting the buffer theory.

Knight and Li (2006) concern themselves with the effect of unemployment duration on re-employment wages. To investigate this relationship, they use data taken from a

2000 household study in urban China. China is unique in this period as 37 million workers were laid off between 1995 and 1999 due to restructuring of Chinese state enterprises. This paper holds relevance to the work carried out in this thesis as there is a focus on the factors that cause re-employment wages to fall relating to depreciation of human capital. Accordingly, Knight and Li hypothesize that longer spells of unemployment will lead to lower re-employment wages. Their study differs from wage curve based studies as they regress log earnings upon unemployment duration, not the unemployment rate (along with standard explanatory variables). They find unemployment duration to be exogenous (alleviating concerns that due to endogeneity, high reservation wages will result in individuals holding out for higher paying jobs, increasing unemployment duration) and not sensitive to selectivity. Knight and Li's results do support their hypothesis, confirming that as length of unemployment period increases, re-employment earnings decrease, however, their sample size of just over 300 workers is small in comparison to other studies.

Sans-de-Galdeano and Turunen (2006) add to the literature by estimating a wage curve for the Euro Area as a whole. The researchers identify the study's importance due to the introduction of the single monetary policy. Sans-de-Galdeano and Turunen make use of a longitudinal dataset, the European Community Household Panel (ECHP), between 1994 and 2001. This longitudinal aspect allows control for composition biases, as workers can be followed over the sample period. Unemployment rates are taken from the REGIO database and are entered into the data at NUTS1 level. Sans-de-Galdeano and Turunen estimate a simple OLS model and a model with added individual fixed effects, both models producing similar results with the only major difference in the reported coefficients concerning education. The OLS model suggests that the wages of the less educated are more sensitive to the unemployment rate, whilst the individual fixed effects model suggests there is no difference in unemployment elasticity across different education groups. Both models produce results that imply that the wages of men and younger workers are more elastic within the Euro Area. Sans-de-Galdeano and Turunen hypothesize that the wages of public sector workers are primarily influenced by national labour market conditions. Results confirm this hypothesis, with results also showing that the regional unemployment rate affects private sector workers far more than public sector workers. Sans-de-Galdeano and Turunen also employ a quantile regression approach, finding that (using NUTS1 unemployment rate level), at lower levels of the wage distribution, elasticity is highest, decreasing at higher levels of the wage distribution.

Baltagi *et al.* (2008) examine the wage curve in Western Germany using a sample of 974,179 over the time period 1980 to 2004. Baltagi *et al.* have disaggregated the data down to 326 regional labour markets. They report an unemployment elasticity of wages of -.016 in the short run and -.037 in the long-run. They compare these results to those of similar studies of the UK, noting that the elasticity is smaller in Germany, as a result of the system of wage setting, where unions negotiate at industry level. Baltagi *et al.* conclude that wages are more elastic for groups with weaker bargaining power, supporting this with elasticities concerning men versus women, younger versus older workers and natives versus foreigners, in line with results of previous studies. It is found that highly qualified workers have a slightly greater unemployment elasticity of wages than less qualified workers, but the elasticity estimate for the more highly educated is not significant. It should be noted that in most previous studies, such as Card (1995), those individuals less educated were found to have greater elasticity, with less protection in the labour market.

Confirmation of the Italian wage curve is sought by Devicienti *et al.* (2008). They note that previous research has indicated the Italian wage curve does not exist (Lucifora and Origo, 1999), blaming Italy's restrictive wage bargaining system, which was replaced in 1993, with a bargaining system designed to improve responsiveness to local labour market conditions. Data comes from the Work Histories Italian Panel (WHIP), between 1985 and 1999. They test for the wage curve using unemployment disaggregated to 20 regions and also test for a structural break in 1993. Devicienti *et al.* find support for the wage curve after 1993, with the responsiveness of wage to unemployment increasing over time (-.027 in 1994-1996, and -.039 in 1997-1999). They calculate elasticity for both the total wage and for the top-up components of wage and find elasticity to be far higher (-.076) for the top-up component, which is more flexible than total wages (although top-ups account for only 22% of total wages, which they use to explain the relatively low elasticity for the total wage). They use a quantile regression approach to further investigate this finding, noting that elasticity increases along the wage distribution, which they attribute to the greater levels of top-up components and their flexibility at higher levels of the wage distribution.

Austria's wage curve is considered by Falk and Leoni (2008), who use annual earnings from 2002 (the 2001 unemployment rate is used). They hypothesize that due to the high level of collective bargaining, the Austrian wage curve will be less elastic than that found in Anglo-Saxon countries. Noting that the responsiveness of wages to local unemployment will differ by gender, they carry out estimations separately for men and women. Unemployment rates are highly disaggregated (121 districts) and the distance between districts is controlled for. As well as controlling for the distances between district capitals, the logarithm of population density is also entered into the earnings equation. From a spatial lag model, the unemployment elasticity of annual earnings is -.03. Using OLS, the elasticity falls to -.017, suggesting that results may be biased if spatial effects are ignored. Falk and Leoni also allow the effects of the unemployment rate to differ for the 25th percentile, median and 75th percentile via the use of a spline function. Results reveal a large elasticity for unemployment rates of 7.3% and above, but elasticity is close to zero at lower unemployment rates, (this figure is very large at -.182). Disaggregating by gender reveals an unemployment elasticity (above 7.3%) of -.169 for men and -.128 for women. They recognize that their result of elasticity increasing with the unemployment rate contrasts with previous results (Buettner, 1999 and Longhi *et al.*, 2006), but note that comparisons are difficult due to differences in methodology, data, country and time period.

Shilov and Moller (2009) estimate the wage curve for Russia, with the aim of testing whether the wage curve operates in post-communist countries. They note that the first calculation of the wage curve in Russia was carried out by Blanchflower (2001), who found a relatively high unemployment elasticity of -.175, over the period 1995 to 1997, using fourteen regions. Shilov and Moller expand their time period to 1995 to 2005, increase the number of regions from 14 to 82 and use a panel dataset to reduce possible endogeneity. General least squares (GLS) estimations yield elasticities of -.101 and -.094, whilst general method of moments (GMM) estimations produce further elasticities close to the value of -.1, confirming that wage curve mechanisms operate in Russia, despite concerns regarding ongoing adjustments to the market economy and possible unreliable data collection.

2.3 Data and Methodology

The primary source of data for this chapter is the Living in Wales survey. The Living in Wales survey is a national omnibus survey designed to provide the Welsh Assembly Government with information about the Welsh population's views and opinions regarding key public services in Wales. It is commissioned by the Welsh Assembly Government and managed by the Local Government Data Unit. Fieldwork is carried out by Ipsos MORI and assisted by GfK NOP. The Living in Wales survey began in 2004, replacing the Welsh House Condition Survey (WHCS), which was discontinued in 1998. The survey consists of two separate surveys: a household survey that is conducted annually, providing information on households, their characteristics and the people living in them; and a property survey, providing information on the structure and condition of properties. The property survey was carried out in 2004 and 2008.

The household survey consists of an interview with the household reference person or their spouse/partner. The interview lasts approximately 50 minutes and contains around 200 questions, although not all questions are answered by all households. The interviews make use of Computer Assisted Personal Interviewing (CAPI) to improve efficiency.

The survey calls for at least 300 households to be successfully interviewed within each local authority each year, with at least 1,000 over 3 years. Each year a sample of approximately 12,000 addresses are chosen from across Wales via the Postal

Address File.[12] A stratified sample is preferred to a purely random sample, as this ensures that smaller local authority areas are adequately represented in the sample. It is checked that addresses from the previous surveys are not revisited in upcoming surveys. Interviews for the 2006 survey were conducted between March and October of that year. 7,443 households completed the questionnaire. This was then grossed to produce an estimate of 1,252,000 households and a population of 2,987,600, implying that each household in the sample contains, on average, 2.39 people.

It should be noted that the Living in Wales survey's focus on providing public opinions hampers it as an economic dataset, in some respects. Firstly, earnings data is banded. The measure of earnings used in this chapter is gross annual pay from the individual's main job. Gross pay is expressed across 53 bands, with irregular intervals, with the top brand representing gross pay above £200,000 per annum. This top band contains 0.4% of the sample. Due to the banded nature of the data, all descriptive statistics are calculated using band mid-points, unless otherwise stated. The banded data necessitates the use of an interval regression technique when estimating the earnings functions.

Secondly, due to the question and answer nature of the survey, any statements made regarding the accuracy of the earnings data must be made with caution. The individual is asked to state their gross pay, therefore there is the chance of an inaccurate response, perhaps due to error, or in an attempt to misrepresent their earnings, either higher or lower than the true amount. In comparison to datasets like the Annual Survey of Hours and Earnings (ASHE), where earnings data comes directly from employers' payroll records, the Living in Wales survey suffers in terms of accuracy.

12 Although not all will consent to be part of the survey.

Thirdly, the standard form of the earnings function in wage curve studies uses the logarithm of average hourly earnings as the dependent variable. However, in the Living in Wales survey, data on hours is only asked of those individuals in part-time employment. Due to this limitation, calculating the average hourly wage is not possible. Instead, annual gross pay is used. This decision is supported by Black and FitzRoy (2000) who claim that due to overtime hours being paid at a premium in answer to demand shocks, the use of annual earnings may be more suitable for wage curve analysis than average hourly earnings. Black and FitzRoy use the Levin and Lin (1993) panel unit root test to compare the suitability of annual earnings against average hourly earnings, with the test supporting their hypothesis. Annual pay has also been used in other studies, such as Falk and Leoni (2008). Collier (2000) uses both hourly and monthly earnings in his study of the wage curve and finds there to be little difference in the elasticities these different measures produce.

In the years between 2004 and 2006, the Living in Wales survey does not contain any data pertaining to an individual's education or qualifications.[13] As education is an integral part of most earnings functions, due to its key contribution to human capital, I have decided to use a proxy for education. The education domain of the Welsh Index of Multiple Deprivation (WIMD) provides a measure of deprivation in education that can be entered into the model at postcode sector level. The WIMD and its contributing domains will be covered in greater detail later in this section.[14]

In addition to the education domain scores, occupation can be used to proxy for education and skills. This is done in two ways. Firstly, I follow the work of Bell *et al.* (2002), who create four skill levels from 2 digit SOC codes. Secondly, 1 digit standard occupational classification (SOC) dummies variables can be used, which control for the occupation the individual is employed in and their skills, as Bell *et*

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13 Questions on education and qualifications are included for the first time in the 2008 survey.
14 It is fortunate that these issues are not encountered in the remaining empirical chapters, as the data source used in these chapters, the Annual Population Survey, contains earnings data that is unbanded and can be broken down into hourly rates. Information on education and qualifications is also available.

al.'s method does, but allows for greater variation in occupation (and skill) levels. All three methods are tested in table 2.4 in the results section.

This allows us to take advantage of several different measures of labour market slackness. The ILO unemployment rate will be entered into the model at unitary authority level and the claimant count rate will be entered at unitary authority and postcode sector level. The ILO unemployment rate and the claimant count rate do not gage joblessness in the same way. Whilst the unemployment rate accounts for those persons without a job, but wanting to work, available to work and actively seeking jobs, the claimant count is only a record of persons claiming unemployment benefits. As not all unemployed persons choose to claim unemployment benefits (or may be ineligible) the resulting rates (calculated as a proportion of the working age population) are smaller. It has been noted[15] that the difference in unemployment rate and claimant count rate grows when the employment level is high, as persons jobless but previously not seeking employment are enticed to begin searching, therefore becoming part of the unemployment rate. Table 2.1 gives the average unemployment rate and claimant count rate at unitary authority level over the years 2004 to 2006 from the data used in this chapter.

Table 2.1

Unemployment Rate & Claimant Count Rate

	Unemployment Rate	**Claimant Count Rate**
2004	5.44%	3.35%
2005	6.09%	3.34%
2006	6.14%	3.54%

The use of these two measures will allow me to test whether those who are unemployed (but may not be claiming benefits) place as much downward pressure

[15] Machin (2004).

on wages as those who are claiming unemployment benefits. Additionally, claimant count rates are entered at postcode sector level (the lowest level the Living in Wales survey allows disaggregation to, of which there are 515 in Wales). As unemployment rates are not published at such a level of disaggregation, it is only possible to use the claimant count. These rates are constructed from the claimant count and the Office of National Statistics' (ONS) population estimates at lower layer super output area (LSOA). These figures are then converted, using population weights, to postcode sector level. The following chapter also tests the effects of using differing levels of aggregation, expanding this methodology to five levels.

In addition to the measures of total unemployment, the effect that long-term unemployment[16] has upon the wage level and the wage curve relationship is tested. Unemployment produces downward pressure on local wages, but as an individual is unemployed for a great deal of time, their downward pressure they exert on wages will decrease. This may be due to their human capital attributes declining and their job search effort falling (perhaps due to the demoralising effect of repeated failures in finding a job), therefore decreasing the probability of them finding a job in the future and increasing the probability of them leaving the labour market and becoming economically inactive.

In Wales in the 21st century, perhaps the greater problem is not unemployment or long-term unemployment, but the high level of economic inactivity (although both unemployment and long-term unemployment may lead to inactivity). Wales' inactivity levels are greater than any other region in the UK, with the exception of Northern Ireland. Inactivity means that an individual of working age, is not in employment or is not classed as unemployed, effectively they are not part of the labour market. The high levels of inactivity may be one of the driving forces behind Wales' low employment and earnings figures. Inactivity may also be a source of hidden unemployment, distorting unemployment figures and diminishing their value to research and effective policy suggestions. Inactivity is a major problem in Wales

16 Classed as those individuals unemployed for 12 months or more.

and inactivity rates will be inserted into the model, to better understand the effect on earnings.

Hypothesis tests have been carried out in this chapter (and throughout the thesis) as a way of determining the statistical significance of the results obtained. T-statistics are presented in all result tables along with the coefficient estimates as an indicator of statistical significance. Significance is defined at the 1% (***), 5% (**) and 10% (*) levels when the t-statistic exceeds the critical values of 2.576, 1.96 and 1.645. Other testing has been used during this work, such as the Hausman test for endogeneity, instrumenting with lags of the unemployment rate.

Specification

This sample has been restricted to working age males in full-time employment. The self-employed have been excluded due to concerns over the accuracy of reported earnings, a concern compounded by the method used to gather earnings data in the Living in Wales survey. These restrictions leave a sample of 8,486.

To examine the wage curve relationship in Wales, an augmented Mincer (1974) earnings function is used, specified as:

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \varepsilon_{irt} \qquad (1)$$

Where E is the log of annual earnings, X is a vector of personal characteristics, IND is a vector of industry dummy variables, RURAL is a dummy variable to define rural/urban status and YEAR is a set of dummy variables indicating when the respondent was included in the sample. a is a constant and ε is the error term. OCC is a set of occupation dummy variables (although the explanatory powers of a set of four skill levels based on Bell *et al*. (2002) is also be tested). U is the regional unemployment rate. This will be replaced by claimant count rate (at unitary authority and postcode sector levels) in later regressions.

When estimated, the coefficient on the unemployment term (λ) will give the unemployment elasticity of earnings. Blanchflower and Oswald (1994) suggest that this should be -.1, following their declaration of the wage curve as an empirical law of economics, however, the previous review of the wage curve literature has suggested that this number may vary considerably, but it should be negative, as the wage curve details an inverse relationship between the unemployment rate and the level of earnings (a positive coefficient would support the theory of compensating differentials). Nijkamp and Poot's (2005) meta analysis calculates the mean unemployment elasticity (from 208 results) to be -.1184, but after correcting for publication bias, they claim that the actual wage curve 'average' should be approximately -.07.

Controls for industry are based on the Standard Industrial Classification (SIC) 2003. Occupation controls consist of a set of SOC dummies (the skill levels approach devised by Bell *et al.* (2002) is also tested). The rural dummy variable is classed as those areas listed as town and fringe, village and hamlet and isolated dwellings, as opposed to those in a predefined urban category (classed as greater than 10,000 population)[17]. The year dummy variables consist of the year that the individual was interviewed in. No finer breakdown of time of interview is available. In trying to control for individual characteristics, age, age^2 and ethnicity are included. Definitions of these variables are included in the appendix. In addition I utilize the domain scores of the WIMD (which are covered in detail later in this section). They are added into the model according to their level of weighting to the full WIMD. This gives specifications 2 to 6:

17 As defined by the Office of the Deputy Prime Minister.

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \varepsilon_{irt} \quad (2)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \varepsilon_{irt} \quad (3)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \alpha ACCESS_r + \varepsilon_{irt} \quad (4)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \alpha ACCESS_r + \alpha HOUSING_r + \varepsilon_{irt} \quad (5)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \alpha ACCESS_r + \alpha HOUSING_r + \alpha PHYSICAL_r + \varepsilon_{irt} \quad (6)$$

Specifications (2) to (6) include the domain scores of the WIMD, cumulatively, in order of their weighting to the overall WIMD. The order is education (EDUC), health (HEALTH), geographical access to services (ACCESS), housing (HOUSING) and physical environment (PHYSICAL). In specifications (7) to (11), the domain scores are included in the model separately:

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \varepsilon_{irt} \quad (7)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha HEALTH_r + \varepsilon_{irt} \quad (8)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha ACCESS_r + \varepsilon_{irt} \quad (9)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha HOUSING_r + \varepsilon_{irt} \quad (10)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha PHYSICAL_r + \varepsilon_{irt} \quad (11)$$

To gauge the effect of labour market proximity on annual pay, long-term unemployment and inactivity are incorporated into the model. Following the methodology of Blackaby and Murphy (1991), the proportion of unemployed who have been unemployed for 52 weeks or more are inserted into the regression, along with the log unemployment rate. The proportion of long-term unemployed are entered linearly and in log form. The inclusion of long-term unemployed (LTU) in specifications is denoted with a single apostrophe and a double apostrophe indicates the inclusion of long-term unemployed, entered in log form, as shown below:

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha LTU_{rt} + \varepsilon_{irt} \quad (1')$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha \ln LTU_{rt} + \varepsilon_{irt} \quad (1'')$$

Where appropriate long-term claimants are used instead of the long-term unemployed. For inactivity, I enter the logarithm of the inactivity rate into the model (specification 12), both with and without log unemployment/claimant count rates. In addition, to test whether it is the inactive people who would like to work but are unable to or those who do not want to work who place the greatest downward pressure on wages, these rates are entered into the model in place of the full inactivity rate (separately in specifications 13 and 14 and together in specification 15). The scores of all five WIMD domains are included in inactivity specifications.

$$\ln E_i = a + \delta \ln INACT_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \alpha ACCESS_r + \alpha HOUSING_r + \alpha PHYSICAL_r + \varepsilon_{irt} \quad (12)$$

$$\ln E_i = a + \delta \ln WANTJOB_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \alpha ACCESS_r + \alpha HOUSING_r + \alpha PHYSICAL_r + \varepsilon_{irt} \quad (13)$$

$$\ln E_i = a + \delta \ln DONTWANTJOB_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \alpha ACCESS_r + \alpha HOUSING_r + \alpha PHYSICAL_r + \varepsilon_{irt} \quad (14)$$

$$\ln E_i = a + \delta \ln WANTJOB_{rt} + \delta \ln DONTWANTJOB_{rt} + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha RURAL_r + \alpha YEAR_t + \alpha EDUC_r + \alpha HEALTH_r + \alpha ACCESS_r + \alpha HOUSING_r + \alpha PHYSICAL_r + \varepsilon_{irt} \quad (15)$$

Welsh Index of Multiple Deprivation 2005

The Welsh Index of Multiple Deprivation 2005 is a measure of deprivation across Wales at LSOA level. It was commissioned by the Welsh Assembly Government and was produced by the Assembly's Statistical Directorate and the Local Government Data Unit. It measures deprivation, classed as "problems caused by a general lack of resources and opportunities (not just money)"[18], for seven separate domains. Each LSOA is ranked in terms of deprivation for each domain and assigned a deprivation score, 100 being the most deprived, 0 being the least deprived. Deprivation scores are assigned via an exponential transformation.[19] Due to this method, only the most deprived 10% of LSOAs will have a score of 50 or over. Then the scores for each domain were combined to create the full WIMD, with the following weighting:

Income	25%
Employment	25%
Health	15%
Education, skills and training	15%
Geographical access to services	10%
Housing	5%
Physical Environment	5%

For the purposes of this chapter, however, the individual domain scores are used. The income and employment domains will not be used, due to their correlation with the earnings variable and existing measures of labour market slack. It is hoped that by including the WIMD domain scores as explanatory variables, it will be possible to control for a variety of regional differences. It is likely that the domains will be correlated with each other (and with the measures of labour market slackness), so whilst they may be picking up the effects of more than their specific domain, this can

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19 The exponential transformation used requires a LSOA's rank to be scaled between 0 and 1 (1/1896 for the least deprived, 1 for the most deprived), giving R. This is then transformed via the formula:

$$-23^{*}\log\{1-R^{*}[1-\exp(-100/23)]\}$$

to give each LSOA's deprivation score for each particular domain. More information on this method is available in the WIMD 2005 technical report, available from www.dataunitwales.gov.uk work in my favour as they may control for a wider range of regional differences, especially when all five domains are included.

The domain variables constructed are entered into the model according to their weighting in the overall Welsh Index of Multiple Deprivation. The income and employment domains carry the most weight, but since I have decided to exclude these domains, I next come to the health and the education, skills and training domains, both of which hold a weighting of 15%. Due to the lack of information on education and qualifications in the Living in Wales survey, the education domain can be used as a proxy for respondent's education and qualifications (in conjunction with information on respondent's occupation). Therefore, the education domain will be the first entered, followed by the health domain. The remaining domains are entered in the following order: geographical access to services, housing and, finally, the physical environment. Domain scores are included together, in that order, to make up specifications (2) to (6), whilst they are entered into the model individually in specifications (7) to (11). Each LSOA's score was converted to postcode sector level via population weights before inclusion in the model (postcode sector is the smallest geography reachable using the Living in Wales survey).

Understanding the construction of each of the domains will aid in interpreting the effects of deprivation on wages and the wage response to unemployment. Here it is explained how each domain was constructed and which indicators of deprivation were used.

Education, Skills & Training Domain

The stated aim of the education domain is "to reflect the 'stock' and 'flow' or educational disadvantage within an area, by capturing low attainment among children and young people and the lack of qualifications and skills in adults".[20] The

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following indicators were used to construct the education, skills and training domain (factor analysis was used to combine the indicators. Weights are included in parentheses):

- Key Stage 2, average point scores (0.11)
- Key Stage 3, average point scores (0.24)
- Key Stage 4, average point scores (0.25)
- Secondary school absence rates (0.08)
- Proportion of 16 to 18 year olds not entering further or higher education (0.15)
- Proportion of adults with low or no qualifications (0.31)

From this information, it is believed that the variable will capture and control for educational deprivation at a small area level (postcode sector level), which, along with the respondent's occupational sector details, will provide an adequate proxy for respondent's educational attainment.

Health Domain

The health deprivation domain includes the following indicators:

- Limiting long-term illness (0.29)
- Standardised all-cause death rate (0.55)
- Standardised cancer incidence rate (0.20)

The health domain's high weighting to the overall Welsh Index of Multiple Deprivation reflects the belief that the aggregated health of a small area should have one of the larger effects on wages, out of the five domains used.

Geographical Access to Services Domain

This domain will capture the effect of settlements which may be isolated from a range of services required for general daily activities. If the service is unreachable by either foot or public bus services, within the specified time, this indicates deprivation exists. The components of the geographical access to services domain are:

- Food shop within 10 minutes (0.08)
- GP surgery within 15 minutes (0.15)
- Primary school within 15 minutes (0.24)
- Post office within 15 minutes (0.24)
- Public library within 15 minutes (0.07)
- Leisure centre within 20 minutes (0.07)
- NHS dentist within 20 minutes (0.12)
- Secondary school within 30 minutes (0.12)

Housing Domain

The housing deprivation domain is constructed from just two indicators:

- Lack of central heating
- Overcrowding (excluding all student households)

Factor analysis is not used in the construction of this domain; each indicator is given equal weighting. There exist some concerns that the indicators used to construct the housing deprivation domain may not fully capture housing deprivation and its effect on local wages. The Welsh Index of Multiple Deprivation 2005 technical report states that lack of central heating is used as a proxy measure for housing quality instead of a more direct measure, as it is available at LSOA level.

Physical Environment Domain

The purpose of the physical environment domain is "to represent potential for impacts on quality of life in terms of environmental factors that increase the potential for an area being viewed as a less pleasant or desirable place to live."[21] Due to the intended aim of the domain, the effects on earnings may be small, with low correlation. The physical environment domain consists of the following indicators:

- Population averaged estimated air quality for each LSOA in relation to Air Quality Strategy objectives
- Population averaged estimated emissions to air per LSOA
- Proportion of residential population living within 1 kilometre from current and recent waste disposal sites (landfills and incinerators)
- Proportion of residential population living within 1 kilometre from a significant industrial source.
- Proportion of residential population living in an area with a significant risk of flooding.

Factor analysis is not used for creating this domain. Instead, three sub-domains are created (air pollution, proximity to regulated sites and flood risk) which have equal weighting in the physical environment domain.

Correlations between the measure of earnings and the individual domain scores of the WIMD (table 2.2) reveal that the largest correlation with annual pay comes from the education domain, as would be expected, with the health domain being the second most correlated domain. The correlation between the wage measure and the education and health domains is negative, reflecting that the domain scores measure deprivation and therefore high scores would be associated with lower wages. As suspected, the physical environment domain displays very little correlation with annual pay. The geographical access to services domain is positively correlated to

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Table 2.2

Correlations between Annual Pay and Welsh Index of Multiple Deprivation 2005

	Annual Pay	Education	Health	Access	Housing	Physical
Annual Pay	1					
Education	-.1801	1				
Health	-.1439	.7260	1			
Access	.0908	-.4906	-.5240	1		
Housing	-.1057	.2422	.0805	-.0042	1	
Physical	-.0248	.2252	.1450	-.3296	.0279	1

Note: unemployment rate (U Rate) and claimant count rate (CC Rate) expressed at unitary authority level.

Table 2.3

Correlations between ILO Unemployment Rate, Claimant Count Rate and Welsh Index of Multiple Deprivation 2005

	U Rate	CC Rate	Education	Health	Access	Housing	Physical
U Rate	1						
CC Rate	.7449	1					
Education	.3763	.4112	1				
Health	.5636	.5327	.7430	1			
Access	-.3296	-.3544	-.5074	-.5338	1		
Housing	-.1635	-.0636	.2410	.0744	-.0003	1	
Physical	.0712	.0562	.2452	.1655	-.3449	.0389	1

Note: unemployment rate (U Rate) and claimant count rate (CC Rate) expressed at unitary authority level.

annual pay. This may be due to carrying out this research using place of residence, as some of those who earn high wages, may commute into work from areas outside cities (which may then be classified as access deprived).

Table 2.3 shows that correlations between the unemployment rate and claimant count rates are largest for the health domain, followed by the education domain. Negative correlations are found between the measures of labour market slackness and the access and housing domains. In this case, positive correlations between deprivation and measures of labour market slack would be expected. The negative correlation with access may be explained by clusters of unemployment in towns and cities. The negative relationship between housing deprivation and the measures of labour market slack may suggest that a lack of heating and overcrowding may not accurately measure housing deprivation.

Summary Statistics

From the 8,486 individuals in the sample, the average of gross pay from main job is found to be £24,493 (calculated from mid-points). This is lower than data from ASHE for the same period would suggest, by around £1,500. There are several possible reasons for this disparity: the Living in Wales mean is calculated from banded figures, the samples between the Living in Wales Survey and ASHE differ, and the accuracy of earnings data in the Living in Wales Survey may be questionable, as respondents may downstate their earnings for a multitude of reasons. The average age of persons in the sample is 42. The descriptive statistics also show that 36% of the sample lives in rural areas. Full summary statistics are included in the appendix (table 2.A1).

From figure 2.1, the distribution of earnings across Wales can be seen to be focused on a level below the mean value of £24,508. It can be seen that the majority of individuals earn less than £50,000 per year, with under 5% earning above that figure,

Figure 2.1

Gross Annual Pay

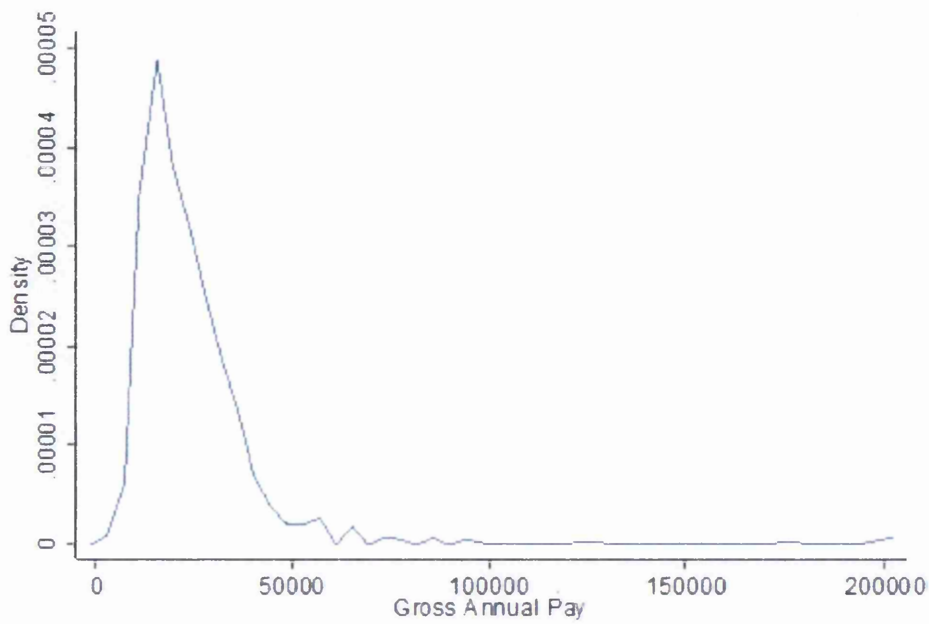


Figure 2.2

Gross Annual Pay (<£50,000)

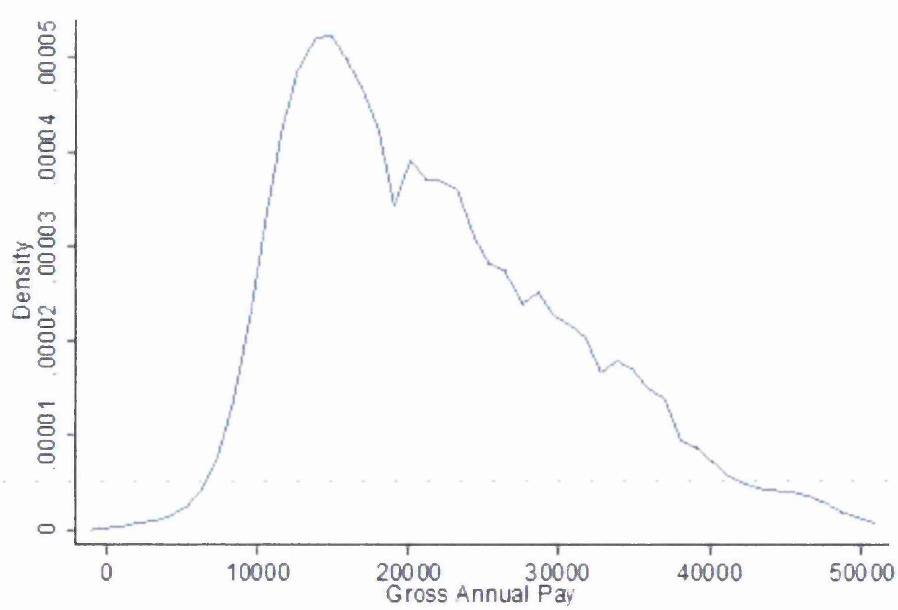


Figure 2.3

Gross Annual Pay by Rural/Urban Status

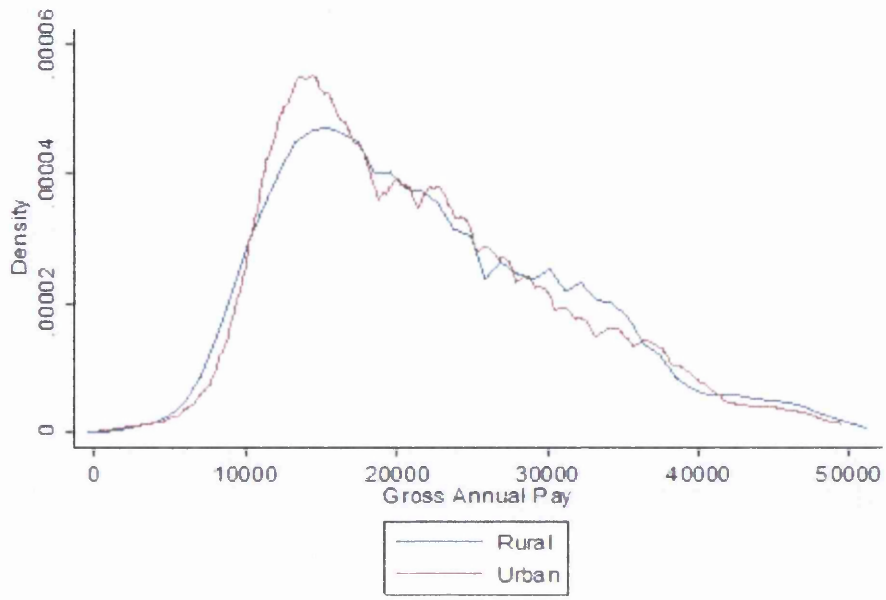
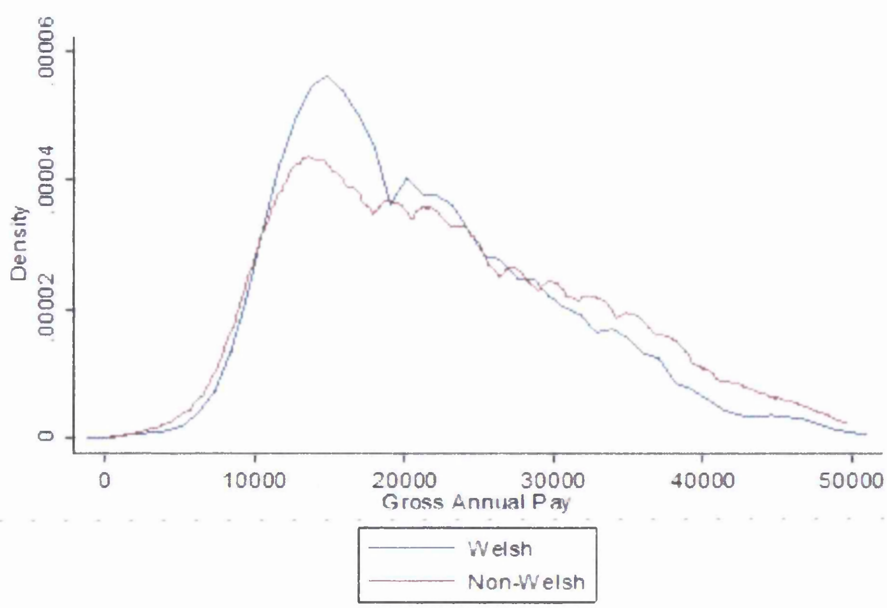


Figure 2.4

Gross Annual Pay by Welsh/Non-Welsh



illustrated by the extended, flat right hand tail. For this reason, the distribution of earnings can be better seen if the focus is on the portion of the distribution up until the £50,000 level. By focusing on the distribution between zero and £50,000 (figure 2.2), it can be seen that the distribution of earnings focuses on the area around £15,000, which is below the mean value of £24,508. The average is obtained due to the shape of the distribution, which has a positive skew, with the mean larger than the median. Disaggregating by urban/rural divide does not show much difference in earnings distributions (figure 2.3). A greater proportion of individuals living in urban areas have earnings around the £15,000 level, which is lower than the mean, reflecting the slightly higher level of earnings in rural areas in the sample (£25,696 to £23,841). Figure 2.4 demonstrates the advantage in earnings that those who have migrated to Wales have over those born in Wales. Those born in Wales have a higher proportion around the median of £15,000, with the earnings distribution of those born outside of Wales rising above those born in Wales after the mean of £24,508, indicating a higher proportion of non-Welsh individuals have above average earnings.

2.4 Results

The methods of controlling for education and skills discussed in the methodology are tested in table 2.4. Initial calculations of the unemployment elasticity of annual pay using no controls for education, find it to be equal to -.11958. This is close to the figure suggested by Blanchflower and Oswald (1990). The inclusion of four skill levels, as suggested by Bell *et al.* (2002) lowers the coefficient to -.09599. A notable change is the increase in the coefficient of determination (R^2), which has risen from .1157 to .2723 due to the inclusion of the skill level dummies. I next test including a set of dummies for the nine 1 digit SOC categories instead of the four skill levels. This lowers the coefficient and increases the R^2, although there is little difference between methods. Whilst there is little difference, inclusion of SOC dummies explains marginally more of the variation than the skill levels, so a set of SOC dummies are included in the basic specification (1). The bottom section tests the inclusion of the education domain, without skill level or SOC dummies. The elasticity is halved from -.11958 to -.04718, but the R^2 only increases slightly, from

.1157 to .1349. Columns 2 and 3 of table 2.4 reveal that the elasticity calculated using the claimant count rate is greater (in absolute terms) than that found using the ILO unemployment rate, with the rates entered at unitary authority and postcode sector levels giving similar estimates. This initial result would suggest that those who claim unemployment benefits place the largest downward pressure on annual pay. Effects of adding skill level and SOC dummies are similar to those found using the unemployment rate. The coefficient of determination's role in measuring the level of variation that can be explained by a model is a key part of chapter four, where it is used to determine whether places or the people who live in them explain the most variation in earnings, employment and economic activity.

Using a set of SOC dummies to control for education and skill differences, a full set of regression results from specification (1) are reported in table 2.5. The full set of results from specification (1) gives an unemployment elasticity of earnings of -.09161. This is significant at the 1% level. The expected signs are displayed on age and age^2. No significant effect is found from the dummy variables for rural/urban status and ethnicity. Relative to the omitted category of utilities, finance is the only industry to have a positive coefficient. Most are negative, whilst three are insignificantly different from the baseline group. Administrative and secretarial occupations are omitted, with managerial, professional, and associate professional and technical occupations displaying positive coefficients. Skilled trades are insignificant, whilst the remaining occupations return negative coefficients. Year dummies rise in magnitude with time, suggesting earnings have risen over the sample period. From this point on, I will no longer report full results, only the coefficient on the logarithm of unemployment. Coefficients on the domain sores from the WIMD 2005 will also be reported.

Tables 2.6 to 2.11 give the results of regressions of the log of annual earnings upon log ILO unemployment rate, log claimant count rate at unitary authority level and log claimant count rate at postcode sector level. Domain scores from the Welsh Index of Multiple Deprivation 2005 are also entered into regressions (at postcode sector level) in order of their weighting to the overall deprivation index. Educational

Table 2.4

Test of Education/Skills Proxies

	Unemployment Rate (UA)	Claimant Count Rate (UA)	Claimant Count Rate (PCS)
No Controls			
Elasticity	-.11958***	-.16522***	-.16274***
t stat	(7.92)	(8.15)	(14.71)
R^2	.1157	.1163	.1313
Skill Levels			
Elasticity	-.09599***	-.12653***	-.11331***
t stat	(7.01)	(6.88)	(11.18)
R^2	.2723	.2723	.2791
SOC			
Elasticity	-.09161***	-.12391***	-.10851***
t stat	(6.71)	(6.76)	(10.72)
R^2	.2791	.2793	.2854
WIMD Education			
Elasticity	-.04718***	-.05929***	-.08409***
t stat	(2.98)	(2.76)	(5.62)
R^2	.1349	.1348	.1373

Notes: results from specification (1); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; (UA) is unitary authority level; (PCS) is postcode sector level; panel 1 has no controls for education/skills; panel 2 controls for education/skills via Bell *et al.*'s (2002) method of skill level dummies; panel 3 controls for education/skills via a set of occupation dummies; panel 4 controls for education/skills via domain scores from the WIMD 2005.

Table 2.5

Full Results from Specification (1)

	Coefficient	t stat
Log U	-.09161***	6.71
Age	.06154***	16.48
Age^2	-.00066***	15.18
Rural	-.0069	0.65
White	.04211	1.09
Industry		
Agriculture, Fishing & Forestry	-.3835***	4.80
Mining	-.3681***	6.74
Manufacturing	-.14759***	3.85
Construction	-.12828***	3.22
Trade	-.29609***	7.34
Distribution, Hotels & Restaurants	-.49744***	9.37
Transport & Communications	-.16914***	4.18
Finance	.15038***	2.75
Real Estate	-.02886	0.71
Public Administration	-.02328	0.55
Education	-.1008**	2.20
Health	-.16464***	3.83
Community	-.26043***	5.83
Private Households	-.47294	1.48
Occupation		
Managerial	.40798***	16.60
Professional	.39128***	14.72
Associate Professional & Technical	.09475***	3.78
Skilled Trade	.02571	1.06
Personal Service	-.29266***	7.85
Sales	-.10573***	3.23
Process, Plant & Machinery	-.09819***	4.02
Elementary	-.26521***	9.80
Year		
2005	.03718***	3.05
2006	.04126***	3.35
Constant	8.3415***	81.39

Notes: results from specification (1); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

deprivation is entered first due to its implications for earnings, as a measure of human capital (or in this case, human capital deprivation).

Regarding table 2.6, the log unemployment rate is found to be highly significant in all specifications. Initially, an unemployment elasticity of -.09161 is found, which is very close to Blanchflower and Oswald's suggested value of -.1. This result would imply that a doubling of the unemployment rate would cause wages to fall by 9.16%. This is similar to the unemployment elasticity at unitary authority level found the chapter three using a different dataset (-.07903 for wales and -.12211 for the UK). It is possible that this figure of -.09161 could be overstated due to the use of annual pay instead of hourly earnings. Comparing the two methods, Nijkamp and Poot (2005) find that elasticities calculated using annual earnings are greater than hourly earnings (-.1365 to -.0628). When introducing measures of deprivation (specifications 2 to 6), the unemployment rate's significant contribution to the determination of annual pay remains, but the magnitude of the unemployment elasticity falls to between -.04839 and -.07176. This fall in magnitude (along with lesser falls in significance, although never below the 1% level) may be attributable to the amount of earnings determination that is dependent upon deprivation in each locality. When all domain scores are included cumulatively, only the education and housing domains are significant. Both are negative, as would be expected and are of comparable magnitude. In a surprising result, the unemployment elasticity increases in magnitude when housing deprivation is entered into the model, but this may be explained by my earlier concerns regarding whether the individual components of the housing domain (lack of central heating and overcrowding) truly control for regional housing differences (as house prices would). The use of mean house prices as a control for regional variation is explored in chapter 3. In table 2.7, each domain score is entered into the model individually (specifications 7 to 11). The largest coefficient on domain scores we find is for education, which is used to proxy for qualification differences, in the absence of individual information. The geographical access to services and physical environment domain scores remain insignificant, suggesting they have little effect on wages. As seen in table 2.6, inclusion of the housing domain again causes the unemployment elasticity to increase (to -.10724).

Table 2.6

Unemployment Rate Results (WIMD Entered Cumulatively)

	1	2	3	4	5	6
Log U Rate	-.09161***	-.05492***	-.04839***	-.05009***	-.07176***	-.07151***
	(6.71)	(3.82)	(3.07)	(3.17)	(4.45)	(4.44)
Education		-.00307***	-.00274***	-.00285***	-.00191***	-.002***
		(7.81)	(5.39)	(5.53)	(3.57)	(3.71)
Health			-.00057	-.0007	-.00077	-.00071
			(1.02)	(1.24)	(1.37)	(1.24)
Access				-.00058	-.00053	-.00043
				(1.28)	(1.17)	(0.94)
Housing					-.00225***	-.00224***
					(6.39)	(6.37)
Physical						.00046
						(1.34)
R^2	.2791	.2846	.2847	.2848	.2882	.2884

Notes: results from specifications (1)-(6); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; U is unemployment.

Table 2.7

Unemployment Rate Results (WIMD Entered Separately)

	1	**7**	**8**	**9**	**10**	**11**
Log U Rate	-.09161***	-.05492***	-.04622***	-.08542***	-.10724***	-.09199***
	(6.71)	(3.82)	(2.93)	(6.02)	(7.83)	(6.74)
Education		-.00307***				
		(7.81)				
Health			-.00247***			
			(5.74)			
Access				.00068		
				(1.61)		
Housing					-.00286***	
					(8.61)	
Physical						.00017
						(0.51)
R^2	.2791	.2846	.2823	.2798	.2857	.2795

Notes: results from specifications (1),(7)-(11); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; U is unemployment.

Table 2.8 presents the results obtained from using claimant count rate at unitary authority level. Specification (1) returns an elasticity of -.12391, slightly higher than the earlier unemployment elasticity of -.09161. This may suggest that whilst the unemployment rate consists of unemployed persons claiming unemployment benefits and those that do not claim unemployment related benefits, it is the people claiming unemployment related benefits that exert the greater downward pressure on wages. Claimant count elasticities are significant for all specifications, ranging from -.06034 to -.08076 with domain scores included. As before, the education domain displays the greatest (negative) coefficients and health is significant, but weakly significant results are found for health deprivation in two of the specifications.

Inclusion of domain scores separately (table 2.9, specifications 7 to 11) reveal a similar pattern to that found using unemployment, where education and health deprivation lower elasticity, the access and physical environment domains are fairly ineffective (and their domain score coefficients remain insignificant) and the inclusion of the health domain causes elasticity to increase slightly.

Table 2.10 presents the results of regressions using the log of claimant count rate at postcode sector level. Specification (1) gives an initial elasticity of -.10851, which is slightly higher than regressions using unemployment rate (-.09161), but lower than claimant count at unitary authority level (-.12391). This level of disaggregation is not tested in chapter three due to the lack of information for ILO unemployment (travel to work area is the most disaggregated level). However, chapter three shows unemployment elasticity falls as disaggregation is extended past unitary authority level. Claimant count rate at postcode sector level is highly significant in all specifications, ranging between -.06566 and -.08364 when deprivation is controlled for. The deprivation domain scores perform better when included with the claimant count rate at the same level, with all but the physical environment domain returning negative and significant coefficients. In addition, the housing domain controls for wage variation as hoped and causes the claimant count elasticity to fall when it is entered into the model. Inclusion of the deprivation scores individually (table 2.11) reveals that education does the best job of controlling for wage variation (as would

Table 2.8

Claimant Count Rate Results at Unitary Authority Level (WIMD Entered Cumulatively)

	1	2	3	4	5	6
Log CC Rate	-.12391***	-.07007***	-.06034***	-.06658***	-.08076***	-.0798***
	(6.76)	(3.58)	(2.86)	(3.10)	(3.74)	(3.70)
Education		-.00305***	-.00267***	-.00279***	-.00191***	-.00199***
		(7.67)	(5.25)	(5.43)	(3.57)	(3.70)
Health			-.00067	-.00081	-.00102*	-.00096*
			(1.22)	(1.45)	(1.83)	(1.71)
Access				-.00072	-.00068	-.00059
				(1.57)	(1.49)	(1.26)
Housing					-.00206***	-.00206***
					(5.95)	(5.93)
Physical						.00043
						(1.26)
R^2	.2793	.2845	.2846	.2848	.2878	.2879

Notes: results from specifications (1)-(6); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; CC is claimant count.

Table 2.9

Claimant Count Rate Results at Unitary Authority Level (WIMD Entered Separately)

	1	7	8	9	10	11
Log CC Rate	-.12391***	-.07007***	-.063***	-.11644***	-.12948***	-.12415***
	(6.76)	(3.58)	(2.98)	(5.93)	(7.09)	(6.78)
Education		-.00305***				
		(7.67)				
Health			-.00247***			
			(5.72)			
Access				.00046		
				(1.05)		
Housing					-.00261***	
					(7.91)	
Physical						.00017
						(0.51)
R^2	.2793	.2845	.2824	.2798	.2849	.2797

Notes: results from specifications (1),(7)-(11); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; CC is claimant count.

Table 2.10

Claimant Count Rate Results at Postcode Sector Level (WIMD Entered Cumulatively)

	1	2	3	4	5	6
Log CC Rate	-.10851***	-.07879***	-.0751***	-.08364***	-.066***	-.06566***
	(10.72)	(5.78)	(5.31)	(5.74)	(4.35)	(4.33)
Education		-.00163***	-.00136**	-.00141**	-.00106*	-.00116**
		(3.25)	(2.41)	(2.49)	(1.86)	(2.01)
Health			-.00052	-.00074	-.00111**	-.00105*
			(0.98)	(1.38)	(2.05)	(1.92)
Access				-.00111**	-.00091*	-.00081*
				(2.39)	(1.94)	(1.70)
Housing					-.00148***	-.00148***
					(4.12)	(4.11)
Physical						.00045
						(1.32)
R^2	.2854	.2863	.2863	.2868	.2882	.2884

Notes: results from specifications (1)-(6); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; CC is claimant count.

Table 2.11

Claimant Count Rate Results at Postcode Sector Level (WIMD Entered Separately)

	1	7	8	9	10	11
Log CC Rate	-.10851***	-.07879***	-.09022***	-.1178***	-.09297***	-.10997***
	(10.72)	(5.78)	(7.12)	(10.31)	(8.66)	(10.81)
Education		-.00163***				
		(3.25)				
Health			-.00112**			
			(2.40)			
Access				-.0008*		
				(1.75)		
Housing					-.0015***	
					(4.27)	
Physical						.00047
						(1.41)
R^2	.2854	.2863	.2859	.2857	.2870	.2856

Notes: results from specifications (1),(7)-(11); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; CC is claimant count.

have been expected) and that access and physical environment are the least effective domains.

Long-Term Unemployment and Claimant Count

In tables 2.12 to 2.14, I test whether the long-term unemployed place any downward pressure on wages. Layard and Nickell (1986) suggest that the long-term unemployed will not exert downward pressure on wages and this has been tested by Blackaby and Hunt (1992) and Johansen (1997). This may be due to de-moralisation and erosion of skills, amongst other factors. The proportion of unemployed who have been unemployed for 52 weeks or more are included. The aforementioned studies find a positive and significant effect on this variable, suggesting that the long-term unemployed do not exert downward pressure on wages. However, results from table 2.12 show that the long-term unemployed do place downward pressure on wages, as the coefficient is negative and significant.[22] This coefficient is negative and significant in all specifications when using the unemployment rate and the claimant count at postcode sector level. Only when using the claimant count at unitary authority level is the effect of the long-term unemployed found to be insignificant in two specifications (5 and 6), although it is significant and negative in the remaining four. These results are somewhat surprising given previous studies, and suggest that the long-term unemployed do place downward pressure on wages (from this dataset, at least). In an attempt to test if the long-term unemployment rate is picking up some effect other than long-term unemployment, I insert a full set of postcode sector dummy variables into the model. The results are given in table 2.15. The effect of including a full set of postcode sector dummies and picking up local variation is that the measures of long-term unemployment (and claimants) become insignificant. The top panel of table 2.15 presents results for unemployment, with both the unemployment rate and long-term unemployed having an insignificant effect on earnings. The effect of long-term claimants is also insignificant although the claimant count rate does have a significant, negative effect on earnings.

[22] I also entered the proportion of unemployed who have been unemployed for one year or more in logarithm form. This makes no difference to the result.

Table 2.12

Unemployment Rate Results, with Long-Term Unemployment (WIMD Entered Cumulatively)

	1'	2'	3'	4'	5'	6'
Log U Rate	-.09456***	-.05913***	-.05508***	-.05675***	-.07815***	-.0778***
	(6.93)	(4.10)	(3.48)	(3.57)	(4.82)	(4.80)
Long Term U	-.24763***	-.2069***	-.20311***	-.20284***	-.19876***	-.19395***
	(4.47)	(3.73)	(3.64)	(3.63)	(3.57)	(3.47)
Education		-.00296***	-.00273***	-.00283***	-.0019***	-.00197***
		(7.41)	(5.37)	(5.50)	(3.56)	(3.66)
Health			-.00035	-.00048	-.00055	-.0005
			(0.62)	(0.84)	(0.97)	(0.89)
Access				-.00057	-.00052	-.00045
				(1.27)	(1.16)	(0.97)
Housing					-.00223***	-.00223***
					(6.35)	(6.34)
Physical						.00036
						(1.05)
R^2	.2809	.2858	.2858	.2859	.2893	.2894

Notes: results from specifications (1')-(6'); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; U is unemployment; LT is long-term.

Table 2.13

Claimant Count Results at Unitary Authority Level, with Long-Term Claimants (WIMD Entered Cumulatively)

	1'	2'	3'	4'	5'	6'
Log CC Rate	-.09571***	-.03228	-.01472	-.0216	-.068**	-.06991**
	(4.29)	(1.36)	(0.57)	(0.81)	(2.42)	(2.48)
Long Term CC	-.26522**	-.34026***	-.37411***	-.34953***	-.09406	-.07335
	(2.21)	(2.83)	(3.07)	(2.81)	(0.71)	(0.55)
Education		-.00314***	-.00261***	-.00269***	-.00192***	-.002***
		(7.88)	(5.13)	(5.21)	(3.59)	(3.71)
Health			-.00095*	-.00102*	-.00106*	-.001*
			(1.70)	(1.81)	(1.90)	(1.77)
Access				-.00045	-.00061	-.00054
				(0.96)	(1.30)	(1.13)
Housing					-.00197***	-.00198***
					(5.29)	(5.33)
Physical						.00041
						(1.18)
R^2	.2798	.2853	.2855	.2855	.2879	.2880

Notes: results from specifications (1')-(6'); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; CC is claimant count; LT is long-term.

Table 2.14

Claimant Count Results at Postcode Sector Level, with Long-Term Claimants (WIMD Entered Cumulatively)

	1'	2'	3'	4'	5'	6'
Log CC Rate	-.08848***	-.04711***	-.04378**	-.05396***	-.04111**	-.04191**
	(6.86)	(2.79)	(2.54)	(2.97)	(2.23)	(2.27)
Long Term CC	-.18698**	-.24267***	-.24144***	-.21305***	-.18534**	-.17724**
	(2.50)	(3.19)	(3.17)	(2.74)	(2.38)	(2.26)
Education		-.00194***	-.00169***	-.00169***	-.00132**	-.00139**
		(3.81)	(2.94)	(2.93)	(2.27)	(2.37)
Health			-.00049	-.00066	-.00103*	-.00097*
			(0.93)	(1.23)	(1.89)	(1.79)
Access				-.00085*	-.00069	-.00061
				(1.78)	(1.44)	(1.27)
Housing					-.0014***	-.0014***
					(3.89)	(3.89)
Physical						.00038
						(1.10)
R^2	.2860	.2872	.2872	.2875	.2887	.2888

Notes: results from specifications (1')-(6'); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; CC is claimant count; LT is long-term.

Inactivity

As mentioned in the previous section, Wales is blighted by very high inactivity rates (21.09% from the data used in this chapter). I have entered the log of inactivity rate in place of the unemployment rate in the earnings equation, the results of which are shown in table 2.16. An inactivity elasticity of -.25024 is initially found, which is far greater than the unemployment or claimant elasticities, suggesting that it is the economically inactive that place the greatest downward pressure upon earnings. This may also be a surprising result, as when distance from the labour market increases it may be expected that the downward pressure on wages will subside. When the unemployment rate and claimant count rates are included alongside inactivity, they are found to be insignificant, with inactivity appearing the dominant effect. In an effort to differentiate inactivity, I have constructed variables representing those that are inactive, but want to work (but are unable to at the present time) and those that are inactive and do not want to work. When entered separately (in log form), in the place of the total inactivity rate, both are significant, with a far greater elasticity for those that do not want to work (-.25053 to -.02815). This would imply that whilst inactivity has the greater effect on earnings, it is those people who are inactive and do not want to find employment that are driving this effect, which is surprising as these people would be expected to have the least proximity to the labour market. Inclusion of the unemployment rate and claimant count rate causes the effect of those who are inactive and want to work to become insignificant. This also occurs when both types of inactivity are entered together. These results suggest that the inactive, in particular those who do not want to work, place a large downward pressure on wages.

It is possible that the large negative inactivity elasticity is picking up some effect other than inactivity on earnings. To attempt to control for any possible regional effects being attributed to inactivity, a full set of dummy variables at postcode sector level are entered into specifications 12 to 15. Results are given in table 2.17. The large negative effect of the inactivity rate is replaced with a lowly significant positive effect. The result of large downward pressure on earnings from inactivity was unexpected; this result suggests it may have been due to the inactivity variable

Table 2.15

Long-Term Unemployment/Claimant Count Results, with Postcode Sector Dummy Variables

	1'	1''
Log Unemployment Rate (UA)	-.00696	-.00537
	(0.25)	(0.19)
Long Term Unemployed (UA)	-.11797	-.02578
	(1.49)	(1.47)
Log Claimant Count Rate (UA)	-.13045*	-.13196*
	(1.71)	(1.74)
Long Term Claimants (UA)	-.46053	-.06774
	(1.34)	(1.40)
Log Claimant Count Rate (PCS)	-.10045*	-.12625**
	(1.92)	(2.24)
Long Term Claimants (PCS)	-.09542	-.0105
	(0.61)	(1.25)

Notes: results from specifications (1') and (1''), with a full set of postcode sector dummies; dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; (UA) is unitary authority level; (PCS) is postcode sector level.

Table 2.16

Inactivity Rate Results

	12	13	14	15
Inactivity	-.25024***			
	(7.43)			
Inactivity – Want Job		-.02815*		-.01851
		(1.85)		(1.22)
Inactivity – Don't Want Job			-.25053***	-.24743***
			(7.97)	(7.85)
Inactivity	-.23545***			
	(6.00)			
Inactivity – Want Job		.00964		-.00366
		(0.54)		(0.20)
Inactivity – Don't Want Job			-.22929***	-.23003***
			(6.91)	(6.89)
Unemployment Rate	-.01377	-.07685***	-.03372**	-.03158
	(0.73)	(4.07)	(1.99)	(1.58)
Inactivity	-.23482***			
	(6.57)			
Inactivity – Want Job		-.01437		-.01181
		(0.91)		(0.75)
Inactivity – Don't Want Job			-.23625***	-.2357***
			(7.32)	(7.30)
Claimant Count Rate	-.02944	-.07443***	-.043*	-.03867*
	(1.29)	(3.33)	(1.95)	(1.69)

Notes: results from specifications (12)-(15); dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 2.17

Inactivity Rate Results, with Postcode Sector Dummy Variables

	12	13	14	15
Inactivity	.12038*			
	(1.74)			
Inactivity – Want Job		-.01261		-.00081
		(0.57)		(0.04)
Inactivity – Don't Want Job			.12771**	.12714**
			(2.11)	(2.03)
Inactivity	.12435*			
	(1.79)			
Inactivity – Want Job		-.01056		.00147
		(0.47)		(0.06)
Inactivity – Don't Want Job			.12678**	.12778**
			(2.10)	(2.04)
Unemployment Rate	-.01951	-.01322	-.014	-.01433
	(0.72)	(0.48)	(0.52)	(0.52)
Inactivity	.16813**			
	(2.34)			
Inactivity – Want Job		-.00445		.01225
		(0.20)		(0.52)
Inactivity – Don't Want Job			.14791**	.15753**
			(2.42)	(2.47)
Claimant Count Rate	-.19822**	-.14858**	-.177**	-.18636**
	(2.57)	(1.96)	(2.35)	(2.41)

Notes: results from specifications (12)-(15), with a full set of postcode sector dummies; dependent variable is the log of annual earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

picking up the effects of factors other than inactivity. The effect of those that want a job is always insignificant. When the unemployment rate is entered into the model (in panel 2) it is insignificant. The claimant count does come through as negative (and large) in the bottom panel of table 2.17. The positive effect of inactivity remains.

2.5 Conclusion

This chapter has investigated the existence of a wage curve for Wales, whilst also exploring the effects of using different measures of labour market slack and the effect that inactivity has upon earnings determination. It was found that the unemployment elasticity for Wales was -.09161, very close to the 'empirical law' of -.1. When replacing unemployment rates with claimant count rates, the elasticity figure was higher, suggesting that persons claiming unemployment related benefits put more downward pressure on wages than those people who are unemployed, yet do not claim unemployment related benefits. The Welsh Index of Multiple Deprivation is used to control for regional differences, but only the education, health and housing domains are able to control effectively for wage variation.[23] The results presented in this chapter (and the following chapter) confirm that unemployment does have a negative impact upon earnings. Given the sharp rises in unemployment over the last few years this demonstrates the importance of schemes, such as Jobs Growth Wales, aimed at reducing unemployment.

Claimant count rates were also entered at a greater level of disaggregation, postcode sector level. The effect of this was to reduce the elasticity figure, although there is little difference in magnitude. The effect of using different levels of unemployment rate aggregation is explored in greater depth in chapter three. That a significant result is found when using such a disaggregated measure of labour market slack may suggest smaller local economies exhibiting their own wage curves, each contributing to the aggregate wage curve. An implication would be that policy makers should be

[23] Although we do not use the income and employment domains.

equally concerned with the economic gaps between regions in Wales as they are with closing the gaps between Wales and the rest of the UK. Efforts should also be directed at reducing economic inequality between regions within Wales.

Very high elasticities were found for the economically inactive. These illustrate the great problem that inactivity is, particularly in Wales, where inactivity is above the UK average. It was found that those people who were inactive and did not want to work placed the most downward pressure on wages. Long-term unemployment was also found to cause wages to fall, with long-term unemployment leading to increases in inactivity, as more people leave the labour market. The addition of a full set of postcode sector dummy variables removed the negative effects of inactivity and the long-term unemployed, suggesting that the negative effects may have been caused by some factor other than inactivity or long-term unemployment. The somewhat ambiguous findng with respect to the effects of economic inactivity may affect policy implications. If those who are economically inactive do indeed place significant downward pressure on earnings, this provides additional reasons to focus on schemes that reconnect disengaged individuals with the labour market. The causes of inactivity must also be addressed, in order to prevent further generations from inflating these already high inactivity figures, with particular attention paid to long term limiting illness, which has proven to be the largest cause of inactivity. This study represents an early attempt to quantify the effect of economic inactivity on earnings and this subject warrants further attention.

Appendix 2.A

Variable Definitions

Earnings	Gross annual earnings of individual. Entered into model in log form
Unemployment Rate	Proportion of economically active that are classed ILO unemployed. Entered into model in log form.
Claimant Count Rate	Proportion of economically active that are claiming unemployment benefits. Entered into model in log form.
Inactivity Rate	Proportion of working age that are classed as economically inactive. Entered into model in log form.
Want Job	Proportion of working age that are classed as economically inactive and want a job. Entered into model in log form.
Don't Want Job	Proportion of working age that are classed as economically inactive and don't want a job. Entered into model in log form.
Long Term Unemployed	Proportion of unemployed that have been unemployed for 52 weeks or more
Long Term Claimants	Proportion of claimants that have been claiming unemployment benefits for 52 weeks or more
Age	Age of individual
Age^2	Square of age of individual

White	Dummy variable taking a value of 1 if individual's ethnicity white, 0 otherwise
Rural	Dummy variable taking a value of 1 if rural, 0 if urban
Industry	Vector of dummy variables indicating industry sector. 15 categories: agriculture, fishing and forestry; mining; manufacturing; utilities; construction; trade; distribution, hotels and restaurants; transport and communications; finance; real estate; public administration; education; health; community; and private households
Occupation	Vector of dummy variables indicating occupation. 9 categories: managers and senior officials; professional; associate professional and technical; administrative and secretarial; skilled trades; personal services; sales and customer service; process, plant and machinery; and elementary
Year	Vector of year dummy variables

Table 2.A1

Summary Statistics for Living in Wales Survey

	Mean	Standard	Min	Max
Gross Annual Pay	24493.44	18644.2	780	200000
Age	42.29142	9.955784	18	64
Age^2	1887.671	851.2383	324	4096
Rural	0.361174	0.480368	0	1
White	0.982818	0.129959	0	1
Industry				
Agriculture, Fishing & Forestry	0.004823	0.069284	0	1
Mining	0.015175	0.122255	0	1
Manufacturing	0.279849	0.448952	0	1
Utilities	0.017527	0.131233	0	1
Construction	0.113751	0.317528	0	1
Trade	0.096342	0.295077	0	1
Distribution, Hotels & Restaurants	0.017175	0.129929	0	1
Transport & Communications	0.099988	0.300002	0	1
Finance	0.014939	0.121318	0	1
Real Estate	0.097636	0.296839	0	1
Public Administration	0.085284	0.27932	0	1
Education	0.047171	0.212017	0	1
Health	0.068815	0.253155	0	1
Community	0.041289	0.19897	0	1
Private Households	0.000235	0.015338	0	1
Occupation				
Managerial	0.154685	0.361625	0	1
Professional	0.118512	0.323232	0	1
Associate Pro. & Technical	0.128158	0.334285	0	1
Administration	0.058222	0.234177	0	1
Skilled Trade	0.176849	0.381563	0	1
Personal Service	0.028135	0.165368	0	1
Sales	0.039274	0.194258	0	1
Process, Plant & Machinery	0.204754	0.403545	0	1
Elementary	0.09141	0.288208	0	1

Year				
2004	0.325899	0.468736	0	1
2005	0.349795	0.476932	0	1
2006	0.324306	0.468142	0	1
WIMD				
Education	20.96471	14.26016	0.35118	76.69798
Health	20.70004	14.10035	0.45159	92.89014
Geographical Access to Services	23.26203	16.28896	2.93041	87.50994
Housing	20.97148	15.11105	0.57062	85.91038
Physical Environment	21.52149	15.43896	0.22434	95.9614

Chapter 3

The Wage Curve in Great Britain: Evidence across the Earnings Distribution

3.1 Introduction

For the past two decades, the wage curve has been a highly active facet of economic research. The wage curve has been touted as an economic law that negatively links the regional unemployment rate with individual earnings. The basis behind the wage curve involves estimating an augmented Mincer (1974) earnings function, with the regional unemployment rate added as an explanatory variable. Blanchflower and Oswald (1990, 1994) found that the resulting unemployment elasticity of earnings should be close to -.1, meaning that a doubling of the local unemployment rate will result in a drop in local wages of 10%. Whilst Blanchflower and Oswald have stated that an unemployment elasticity of earnings of -.1 constitutes an empirical law of economics, Nijkamp and Poot (2005) have found, through a meta-analysis covering over 200 estimates of unemployment elasticity, that the actual figure is -.07, attributing the difference in elasticities to publication bias. Despite the wage curve being closely associated with the works of Blanchflower and Oswald (1990, 1994), the methodology can be seen in an earlier study by Blackaby and Manning (1987), where they find a coefficient of -.16 by regressing the log of unemployment upon the log of earnings.

Whilst the previous chapter estimated the wage curve for Wales between 2004 and 2006, this chapter expands the analysis to estimate the wage curve for the UK between the years 2004 and 2007. To do so, I make use of the Annual Population Survey (APS), an extension of the Labour Force Survey (LFS), which is of particular interest as it provides a greater number of observations than the quarterly LFS, particularly in Wales and Scotland (through the Welsh Labour Force Survey and Scottish Labour Force Survey boosts). I hope to add to the existing literature by examining unemployment elasticity at the regional level as well as at the national level, allowing observation of how the earnings of regions differ in their response to the level of unemployment. Due to the sudden increases in unemployment that have occurred towards the end of the sample period and thereafter, a better understanding of unemployment responses will aid in planning for economic recovery, at the regional level.

In addition, I plan to carry out this research using unemployment rates from five levels of aggregation: NUTS[24] 1, NUTS 2, NUTS 3, unitary authority (UA) and travel to work area (TTWA). This was touched on in the previous chapter using the claimant count at both unitary authority and LSOA level, although it is more fully explored here. The wage curve literature is concerned with the earnings response to local unemployment; however, unemployment measured at differing levels of aggregation will produce differing responses (Buttner and Fitzenberger, 1998). By utilizing unemployment rates from five levels of aggregation, I hope to observe the difference in the earnings response to unemployment when moving from a national to local level. These regressions will be carried out for the sample as a whole as well as splitting the sample according to factors such as age group, gender, occupation, industry, education and employment sector.

Finally, I utilize quantile regression techniques to examine unemployment elasticity across the wage distribution. This allows regression not just at the mean, but at regular intervals along the earnings distribution; more specifically in this analysis at each 10% along the earnings distribution (decile regression). Most wage curve studies focus only on wage flexibility at the mean, however, the wage response to unemployment will differ according to whether an individual has high or low earnings. These quantile regression techniques are combined with the unemployment rates from five different levels of aggregation in an attempt to explain wage flexibility across the wage distribution and at different levels of aggregation. Quantile regression techniques are also used in chapter five to examine how the returns to qualifications vary along the wage distribution.

In section two I present a review of the wage curve literature that concerns itself with quantile regression. Section three examines the data used from the APS, including analysis of earnings regionally and by factors relating to personal characteristics and employment. In section four I present results and analysis from regressions at the mean and quantile regressions, with conclusions drawn in section five.

[24] Nomenclature of Territorial Units for Statistics.

3.2 Literature Review

As I have presented a full review of the wage curve literature in the previous chapter, here I just focus upon those studies that examine the unemployment elasticity of wages across the wage distribution. Buttner and Fitzenberger (1998) focus their study on how the wage response to unemployment varies across the wage distribution and over degrees of centralization. They set out a theoretical model that assumes workers are paid according to either a central wage agreement or local wage agreements. The wages paid under the central wage agreement do not react to local/regional unemployment, but to national unemployment, whilst local wages will react to local/regional unemployment. They set out that there is a tendency for lower paid workers to be paid according to central wage agreements (in Germany), meaning that the lower end of the wage distribution is more representative of centralized bargaining and that the local unemployment rate will have a smaller effect on wages than the national unemployment rate. Alternatively, at higher levels of the wage distribution, workers are more likely to be paid according to local agreements and therefore the local unemployment rate will have a greater effect on wages. To test their theoretical model, Buttner and Fitzenberger use IABS-REG data between 1976 and 1990, which breaks geographic location down into 259 districts. A cell mean regression technique is used. Three levels of unemployment rate are used: local, regional and national. Median regression reveals the effect of the local unemployment rate to be insignificant, but regional and national rates have a significant effect. The insignificance of the local unemployment rate holds across all quantiles, which prompts them to note that districts may be considered too small to be functional labour markets. Buttner and Fitzenberger's theory is proven by their empirical evidence as wages are most sensitive to the national unemployment rate at the lower levels of the wage distribution and are more sensitive to regional unemployment at high levels of the wage distribution.

Sanz-de-Galdeano and Turunen (2006) consider the unemployment elasticity of wages between 1994 and 2001 for the euro area.[25] The European Community Household Panel (ECHP) is used. Similar elasticities are found using ordinary least squares (OLS) and individual fixed effects, -.135 and -.141. They also disaggregate their sample, finding that wages are more responsive for men (compared to women), younger workers, and private sector workers. Results by education levels are sensitive to the model used, but OLS results show the less educated to have the more flexible wages. Sans-de-Galdeano and Turunen's quantile regression results show that it is the workers at the foot of the wage distribution that have the largest unemployment elasticity.

Devicienti *et al.* (2008) use the Work Histories Italian Panel (WHIP) between 1985 and 1999 to examine wage flexibility before and after the introduction of a new wage bargaining system, the Income Policy Agreement (IPA), in 1993. Unemployment rates are entered for 20 administrative regions. They find little support for the wage curve prior to 1993, but find that after the introduction of the IPA (which allowed wages to better respond to local labour market conditions), an elasticity of -.029 is found. They are able to isolate the top-up component of total wages, finding that it is far more responsive, with an elasticity of -.076. They examine how these effects may vary over the wage distribution. They find that both the total wage and its top-up component are significant from the median onwards. Wage flexibility is found to increase along the wage distribution, which Devicienti *et al.* state is due to top-up components making up more of total wage at high wage levels, therefore increasing the ability of wages to respond to local unemployment. This result is found using their 'contract' sample, which excludes some higher earners and fringe workers. Expanding their approach to the whole sample, high wage flexibility is found for both high and low earners (relative to those in the middle of the wage distribution). The high wage flexibility of low wage workers is attributed to the low levels of labour market protection they face.

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[25] Consisting of Germany, Belgium, Luxembourg, France, Ireland, Italy, Greece, Spain, Portugal, Austria and Finland.

Ammermuller *et al.* (2010) investigate wage elasticity in Italy and Germany, focusing their approach on differences in elasticity between groups and also including a quantile dimension. Data is available for Italy between 1991 and 2004, and 1996 and 2003 for Germany. Italy and Germany are selected due to being recognized by OECD for large and persistent regional disparities in their labour markets. The data used is the German Microcensus and the Bank of Italy's Survey on Household Income and Wealth, with models estimated using hourly wages as the dependent variable. For Italy, weak evidence of the wage curve is only found for specifications that omit regional fixed effects. When disaggregating into worker sub-groups, the Italian data still fails to identify a wage curve relationship. Only those with a low level of education report a (weakly) significant relationship between unemployment and earnings, but even this relationship is positive. From their German sample, Ammermuller *et al.* again do not find evidence of the wage curve from their OLS specifications, but do find a weakly significant and negative relationship between unemployment and earnings of -.06 when utilizing an error correction model. After disaggregating by worker groups, the strongest wage curve evidence is found for females and the less educated. Also, East Germany is found to exhibit greater unemployment elasticity than West Germany. Ammermuller *et al.* carry out quantile regressions on both Italy and Germany. With Italian data, a significant and negative relationship between unemployment and earnings is only found, via an error correction model, at the median and sixth decile. At the bottom of the wage distribution, the first decile, the relationship is positive and significant. Italian OLS results (without regional fixed effects) suggest wage flexibility is greatest at lower wage levels. From their German error correction model, Amermuller *et al.* find a significant, negative relationship from the fourth decile and up, with the greater elasticity found at the higher end of the wage distribution. Results are similar for their OLS model with regional fixed effects. Without regional fixed effects, the unemployment rate is significant at all deciles, with the largest flexibility found for high wage workers.

Groth and Johansson (2004) do not consider the wage curve, but their study instead examines the link between the duration of wage contracts (and therefore wage flexibility) and the degree of wage bargaining centralization, which links to the use of several different levels of unemployment measures in this chapter. Groth and Johansson set up a model by which nominal contract length is determined by contract costs, which in turn are determined by the degree of centralization. They recognize that increases in centralization of wage bargaining may reduce contract costs by reducing the number of negotiations required across the economy, but may also increase contract costs as the costs of co-ordination rise with the degree of centralization. This co-ordination cost is labelled as the variable component of contract cost and is increasing and convex in centralization. The fixed component is 'a menu-cost for changing wages' that is independent of the degree of centralization and represents the resources used in any wage negotiation. Groth and Johansson's model predicts that, for a sufficiently large fixed component of contract cost, contract duration will be U-shaped in the degree of centralization. This is due to it being optimal to write lengthy contracts as co-ordination costs rise, an effect that dominates for high levels of centralization, but it may be optimal to write shorter contracts as centralization reduces the fixed contract cost per worker (an effect which dominates at low levels of centralization). Groth and Johansson test this theory using data from 16 OECD countries between 1975-1985 and 1986-1995. Data supports the notion of contract duration being U-shaped in the degree of centralization. They regress contract length upon the degree of central bank independence, variance of total factor productivity, and a set of dummy variables representing three levels of centralization. Coefficients on the dummy variables for low and high levels of centralization are greater than for intermediate levels of centralization. This result holds using both OLS and an ordered probit.

3.3 Data & Methodology

To carry out this research, the Annual Population Survey (APS) is used, between the years 2004 and 2007. The APS combines the quarterly Labour Force Survey with the local Labour Force Survey boosts (the English local Labour Force Survey [LLFS]; the Welsh Labour Force Survey [WLFS]; and the Scottish Labour Force Survey [SLFS]). Also included is the Annual Population Survey Boost Sample (APS[B]), although this boost is only available for 2004 and 2005. Unemployment rates are then linked to the data at NUTS1, NUTS2, NUTS3, unitary authority and travel to work area (TTWA) levels. Whilst in chapter 2 the effect of using different measures of labour market slack (ILO unemployment, claimant count, long term unemployment and economic inactivity) was the focus, with only a short time spent on differing level of aggregation, here the effects of using differing levels of aggregation is the focus. These varying levels of unemployment rates have been chosen to capture the effect of different sized labour markets and as a way of representing levels of wage bargaining centralization, whereby responses to highly aggregated unemployment rates would mainly encompass centralized bargaining and wage responses to disaggregated unemployment rates would represent decentralized bargaining, at a more local level. Unemployment rates between the extremes of the NUTS 1 and TTWA levels would represent intermediate level wage setting. Tables 3.1 to 3.3 give the number of each labour market area included in the data, by year and by gender. Figures vary over the sample period due to classification changes and insufficient observations for calculation of unemployment rates. Whilst the number of NUTS 1, NUTS 2 and unitary authority regions remain constant over time (and sample restriction), there is a small variation in the number of regions at NUTS 3 level and a larger variation at TTWA level. Due to the dwindling sample sizes used for calculating the unemployment rate, when using TTWA level, some unemployment rates are unavailable, so these TTWAs are dropped for the TTWA analysis (official unemployment rates are not available at TTWA level, necessitating calculating them from APS data). A list of these dropped TTWAs can be found in the appendix. This problem is worst in 2006 and 2007 when the APS(B) is not available. Due to the affected TTWAs having relatively small sample sizes and populations, the reduction in overall sample size is minimal compared to the more aggregated labour market analysis. This problem is slight for the NUTS 3 level.[26]

26 Unemployment rate for Orkney Islands (UKM45) are unavailable for males in 2007 and females for 2006, Shetland Islands (UKM46) are unavailable for females in 2004 and Eilean Siar (UKM44) is unavailable for females in 2005. There is also a small change in classification over the time period.

Table 3.1

Number of Labour Market Regions by Year (Full Sample)

	2004	2005	2006	2007
NUTS 1	11	11	11	11
NUTS 2	36	36	36	36
NUTS 3	128	128	129	128
Unitary Authority	200	200	200	200
TTWA	292	288	283	275

Table 3.2

Number of Labour Market Regions by Year (Male)

	2004	2005	2006	2007
NUTS 1	11	11	11	11
NUTS 2	36	36	36	36
NUTS 3	128	128	129	127
Unitary Authority	200	200	200	200
TTWA	283	275	267	261

Table 3.3

Number of Labour Market Regions by Year (Female)

	2004	2005	2006	2007
NUTS 1	11	11	11	11
NUTS 2	36	36	36	36
NUTS 3	127	127	128	128
Unitary Authority	200	200	200	200
TTWA	275	274	249	253

As with previous wage curve studies, an augmented Mincer (1974) earnings function is used:

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha RURAL_r + \alpha \ln POPDEN_r + \alpha YEAR_t + \varepsilon_{irt} \quad (1)$$

Regression will be carried out using ordinary least squares (OLS) methods, with specification (1) given above. The unemployment elasticity of earnings is given by the coefficient on the log of unemployment rate (λ). The dependent variable is the logarithm of hourly earnings (E). A vector of standard control variables (X) includes age and its square, job tenure, a dummy variable for marriage, a dummy for gender, a dummy to indicate the presence of an activity limiting health problem, a set of ethnicity dummy variables, a set of dummies controlling for firm size and a public sector dummy. Education is controlled for via a set of dummy variables, representing the highest qualification held by each individual (of which there are nine levels).[27] A set of time dummies (YEAR) are also included. A set of dummies to control for industry sector (IND) have been included, with employment split into nine industry sectors (taken from the INDSECT variable). This was preferred to more commonly used divisions, such as SIC2003, as some of these groups (such as fishing) suffer from very small sample sizes. a is the constant and ε is the error term.

Specification (1) includes a rural dummy variable, which is assigned at Unitary Authority - Local Authority District (UALAD) level. This is based on the URIND variable, taken from the APS, which is available at individual level between 2005 and 2007. Due to the problem of having no data on the rural/urban split for 2004, a dummy variable is created at UALAD level, taking a value of 1 if 50% or more of the UALAD is classed as rural and a value of 0 if less than 50% of the UALAD is classed as rural (therefore the UALAD would be considered urban). This follows ONS' rural/urban definition, introduced in 2004, where settlements with populations

[27] This represents an advantage over the dataset (the Living in Wales Survey) used in chapter two, which lacked qualifications data and required the use of a proxy.

of over 10,000 are classed as urban and settlements with populations of under 10,000 are classed as rural. Under this classification, there are three types of rural settlement: town and fringe, village or hamlet, and dispersed. Whilst I have controlled for rural/urban status, I also control more directly for population density by including the logarithm of population density at UALAD level (POPDEN), in specification (1). This will help control for agglomeration effects.

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha RURAL_r + \alpha \ln POPDEN_r + \alpha HOUSEPRICE_r + \alpha YEAR_t + \varepsilon_{irt} \quad (2)$$

In attempting to control for more regional variation in earnings, a variable based on house prices is included in specification (2). A measure of house prices is included, taken from data provided by HM Land Registry. The average house price in each UALAD is taken, then the deviations away from the national mean house price are entered into the regression. This methodology is suggested in Blackaby, Bladen-Howell and Symons (1991). This information is not available for Scotland; therefore Scotland is omitted from regressions that include house price data. Due to this factor, I run all regressions with and without the house price variable. This house price variable should be more effective in controlling for regional variation than the housing domain scores used in chapter two.

Another way of controlling for regional variation is to include a set of regional dummy variables, defined at NUTS 1 level. Both specifications (1) and (2) are augmented with this vector of regional dummies, giving specifications (3) and (4).

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha RURAL_r + \alpha \ln POPDEN_r + \alpha REGION_r + \alpha YEAR_t + \varepsilon_{irt} \quad (3)$$

$$\ln E_i = a + \lambda \ln U_{rt} + \beta X_i + \alpha IND_i + \alpha RURAL_r + \alpha \ln POPDEN_r + \alpha HOUSEPRICE_r + \alpha REGION_r + \alpha YEAR_t + \varepsilon_{irt} \quad (4)$$

The impetus to carry out this research using five different levels of unemployment rate was provided by Beuttner and Fitzenberger (1998). Beuttner and Fitzenberger theorize that wages in the lower portion of the wage distribution are primarily determined by central wage bargaining and therefore would be more sensitive to national unemployment. Conversely, wages in the higher portion of the wage distribution are determined by local wage formation and will be more responsive to disaggregated unemployment rates. Beuttner and Fitzenberger use quantile regression techniques to draw out these effects; I will do the same. By using unemployment rates with five different levels of aggregation, I would expect the NUTS 1 level unemployment rate to be one extreme, with high responsiveness at lower parts of the wage distribution and the TTWA level unemployment rate to be the opposing extreme, displaying high sensitivity in the upper parts of the wage distribution. The remaining three levels of unemployment rate (NUTS 2, NUTS 3 and unitary authority) should provide a middle ground, with the greater sensitivity switching from the lower levels of the wage distribution to the upper levels of the wage distribution as the degree of disaggregation increases. The work of Groth and Johansson (2004) also influences this decision, as they determine that contract duration (and therefore wage flexibility) is U-shaped in centralization, a theory I hope to test using a wage curve framework.[28]

Regressions will be carried out for the sample as a whole and then split into separate male and female regressions. When running regressions on the sample as a whole, the unemployment rate used is the combined, non gender specific ILO unemployment rate. When restricting regressions to either male or female, gender specific ILO unemployment rates are used. All unemployment rates are entered yearly, at their respective levels of aggregation.

[28] Both papers are covered in the literature review.

In an effort to better understand the forces driving the elasticities obtained from the primary regressions, further regressions are carried out where the sample is split by industry sector, occupational category (SOC2000) and public/private sector employment status, qualifications, age group and year.

Before presenting regression results, I look at summary statistics of the variables used and also how earnings vary between areas, time and the group divisions mentioned previously. All of the following sample statistics are calculated using sampling weights and are restricted to full-time workers. Average hourly earnings are £11.70 for the full sample, £12.42 for males and £10.59 for females. By relaxing the full-time restriction, allowing the inclusion of part-time workers lowers the mean of hourly earnings, especially for females, who have the greater proportion of part-time workers. Whilst four years may be seen as a relatively short period, it can still be useful to look at how hourly earnings have changed over this time frame.

Table 3.4 gives hourly earnings, over time for the sample as a whole and disaggregated by gender. Also presented, is the percentage change in hourly earnings over the time frame of the sample (2004 to 2007). As expected, hourly earnings have risen over the sample period (by 10.84%), but by disaggregating the sample it is possible to see which section of the population are the main driving forces behind the earnings rise. Here I have disaggregated by gender, revealing an hourly earnings increase of 10.45% for males and 11.96% for females, supporting the notion that the earnings gap between males and females is closing, albeit at a slow rate. A similar type of analysis, foucusing on qualification levels, is carried out in chapter five.

Table 3.5 gives mean hourly earnings by NUTS 1 regions. The largest hourly earnings are found in London, followed by the South East and the East. This is seen for the sample as a whole and when disaggregated by gender. On the lower end of the earnings table, Wales and the North East have the lowest mean hourly earnings, followed by Yorkshire. When considering that the South West has the fourth highest

Table 3.4

Mean Hourly Earnings by Year

	Full Sample	Male	Female
2004-2007	11.70	12.42	10.59
2004	11.16	11.87	10.03
2005	11.52	12.22	10.47
2006	12.02	12.76	10.89
2007	12.37	13.11	11.23
% Change	10.84	10.45	11.96

Notes: % change is the percentage change in mean hourly earnings between 2004 and 2007.

Table 3.5

Mean Hourly Earnings by NUTS 1 Regions

	2004-2007	2004	2005	2006	2007	% Change
Full Sample						
East	12.55	11.83	12.42	12.74	13.18	11.41
East Midlands	10.85	10.12	10.72	11.17	11.20	10.67
London	14.55	14.26	14.12	14.73	15.33	7.50
North East	10.27	9.77	10.12	10.59	10.98	12.38
North West	10.75	10.26	10.48	11.11	11.38	10.92
Scotland	10.99	10.56	10.91	11.31	11.81	11.84
South East	13.07	12.34	12.77	13.34	13.80	11.83
South West	11.18	10.68	10.86	11.60	11.60	8.61
Wales	10.27	9.83	10.35	10.55	11.13	13.22
West Midlands	10.75	10.15	10.49	11.24	11.42	12.51
Yorkshire	10.40	9.99	10.33	10.66	10.94	9.51
Male						
East	13.47	12.62	13.31	13.79	14.17	12.28
East Midlands	11.46	10.71	11.24	11.73	11.91	11.20
London	15.42	15.27	15.08	15.51	15.96	4.52
North East	10.83	10.31	10.69	11.13	11.58	12.32
North West	11.40	10.90	10.95	11.83	12.10	11.01

Scotland	11.65	11.26	11.40	12.06	12.45	10.57
South East	14.19	13.38	13.90	14.45	15.07	12.63
South West	11.98	11.50	11.61	12.38	12.44	8.17
Wales	10.75	10.28	10.89	11.01	11.75	14.30
West Midlands	11.30	10.71	11.08	11.83	11.91	11.20
Yorkshire	10.96	10.58	10.93	11.21	11.42	7.94
Female						
East	11.06	10.49	11.01	11.09	11.63	10.87
East Midlands	9.84	9.17	9.89	10.23	9.99	8.94
London	13.35	12.82	12.80	13.69	14.48	12.95
North East	9.39	8.90	9.26	9.77	10.00	12.36
North West	9.77	9.27	9.79	10.05	10.29	11.00
Scotland	10.02	9.52	10.21	10.22	10.86	14.08
South East	11.26	10.61	11.00	11.55	11.83	11.50
South West	9.85	9.29	9.64	10.34	10.21	9.90
Wales	9.51	9.12	9.49	9.85	10.23	12.17
West Midlands	9.85	9.21	9.54	10.27	10.67	15.85
Yorkshire	9.48	8.99	9.33	9.79	10.16	13.01

Notes: % change is the percentage change in mean hourly earnings between 2004 and 2007.

average hourly earnings, it would seem to support the notion that the North-South divide is still a major issue for the economy of the United Kingdom. With regards to the narrowing of the North-South earnings gap, table 3.5 presents ambiguous evidence. Whilst London and the South West have relatively low rates of earnings growth (7.50% and 8.61%, respectively), the East and South East sport fairly high earnings growth (11.41% and 11.83%). The NUTS 1 regions that have experienced the highest earnings growth over the sample period are Wales (13.22%) and the West Midlands (12.51%). Some interesting differences can be seen between earnings growth rates of males and females at NUTS 1 level, particularly for London. When restricted to males, London has the lowest earnings growth (4.52%), but has the fourth highest earnings growth for females (12.95%), whilst still having the largest mean hourly earnings for both males and females.

Table 3.6 focuses on the North-South divide. Using the NUTS 1 regions to separate the United Kingdom, I have taken the South to consist of London, the East, the South East, and the South West, leaving the North to consist of Wales, Scotland, East and West Midlands, Yorkshire, the North East and the North West. As expected, the South has far higher mean hourly earnings (£13.13 to £10.63 for the sample as a whole, £14.05 to £11.21 for males and £11.72 to £9.73 for females). Of greater interest may be the change in hourly earnings over the sample period. Whilst both regions experience positive growth in earnings across the sample period, the North has experienced significantly larger growth of 11.17% compared to 7.80% for the South (similar figures are found for males and females separately; 10.55% to7.42 % and 12.39% to 8.97%).

Continuing the focus on geographical differences in hourly earnings, table 3.7 presents mean hourly earnings and the percentage change in earnings over the rural/urban split. It can be seen that those residing in urban areas enjoy a slight advantage in hourly earnings (£11.75 to £11.39), a gap which widens when examining workplace. As with the North-South earnings gap, the urban-rural earnings gap appears to be closing, as the hourly earnings of those living in rural

Table 3.6

Mean Hourly Earnings by the North-South Divide

	2004-2007	2004	2005	2006	2007	% Change
Full Sample						
North	10.63	10.12	10.51	10.98	11.25	11.17
South	13.13	12.70	12.95	13.30	13.69	7.80
Male						
North	11.21	10.71	11.04	11.58	11.84	10.55
South	14.05	13.61	13.89	14.22	14.62	7.42
Female						
North	9.73	9.20	9.71	10.05	10.34	12.39
South	11.72	11.26	11.53	11.90	12.27	8.97

Notes: % change is the percentage change in mean hourly earnings between 2004 and 2007.

Table 3.7

Mean Hourly Earnings by Rural/Urban Status

	2004-2007	2004	2005	2006	2007	% Change
Full Sample						
Rural	11.39	10.67	11.21	11.62	12.12	13.59
Urban	11.75	11.21	11.56	12.09	12.41	10.70
Male						
Rural	12.15	11.38	11.98	12.39	12.92	13.53
Urban	12.46	11.93	12.25	12.82	13.15	10.23
Female						
Rural	10.14	9.48	9.94	10.37	10.79	13.82
Urban	10.65	10.09	10.53	10.97	11.30	11.99

Notes: % change is the percentage change in mean hourly earnings between 2004 and 2007.

areas have increased by a greater percentage than those living in urban areas (13.59% to 10.70%).

Table 3.8 gives hourly earnings disaggregated by occupational category. As would be expected, the top earning occupational categories are professional occupations (£16.60) and managers and senior officials (£16.53), followed by associate professional and technical (£12.78). For men, managers and senior officials have the highest earnings, but for women those in professional occupations earn the most. In the previous case, a narrowing of the earnings gap between groups was observed, but here, results are slightly unclear. Whilst managers and senior officials have experienced relatively high earnings growth over the sample period, those in professional occupations have experienced the lowest earnings growth. The largest earnings growth over the sample period was enjoyed by process, plant and machine operatives (12.52%). This figure is being driven by a very large earnings growth for females employed as process, plant and machine operatives (14.17%).

Table 3.9 focuses on divisions by industry sector. The industries leading the hourly earnings rankings are banking, finance and insurance (£14.54) and energy and water (£13.89), a ranking which holds regardless of gender. Agriculture and fishing (£8.03) and distribution, hotels and restaurants (£8.78) are the industry sectors that suffer from the lowest hourly earnings. This result makes the figures for earnings growth over the sample period all the more interesting. The agriculture and fishing sector has experienced an hourly earnings growth of 29.94% between 2004 and 2007, by far the largest growth experienced by any industrial sector. This figure remains fairly constant for both males and females. It is true that the agriculture and fishing sector suffers from under representation, making up just 0.74% of the sample. However, this does mean that the average earnings figures were calculated from over 1,300 individuals. Aside from agriculture and fishing, earnings growth appears quite uniform, with the second largest earnings growth in manufacturing (12.69%). Additionally, there seems to be quite a large difference in earnings growth rates between males and females in the banking, finance and insurance sector, with men receiving an hourly earnings growth of just 8.90%, the second

Table 3.8

Mean Hourly Earnings by Occupation

	2004-	2004	2005	2006	2007	%
Full Sample						
Managers & Senior Officials	16.53	15.70	16.21	17.06	17.47	11.27
Professional Occupations	16.60	15.94	16.39	16.97	17.38	9.03
Associate Pro. & Technical	12.78	12.18	12.77	12.91	13.56	11.33
Administrative & Secretarial	9.09	8.67	8.98	9.39	9.62	10.96
Skilled Trades Occupations	9.26	8.86	9.26	9.41	9.76	10.16
Personal Service Occupations	7.18	6.80	7.20	7.40	7.52	10.59
Sales & Customer Service	7.21	6.90	7.07	7.41	7.59	10.00
Process, Plant & Machine	8.33	7.91	8.26	8.49	8.90	12.52
Elementary Occupations	6.90	6.61	6.82	7.07	7.23	9.38
Male						
Managers & Senior Officials	17.63	16.78	17.27	18.25	18.62	10.97
Professional Occupations	17.36	16.64	17.07	17.80	18.25	9.68
Associate Pro. & Technical	13.62	12.98	13.57	13.81	14.47	11.48
Administrative & Secretarial	9.87	9.52	9.65	10.27	10.22	7.35
Skilled Trades Occupations	9.40	9.00	9.40	9.54	9.91	10.11
Personal Service Occupations	7.99	7.68	7.94	8.12	8.38	9.11
Sales & Customer Service	7.80	7.46	7.58	8.02	8.23	10.32
Process, Plant & Machine	8.55	8.15	8.46	8.69	9.14	12.15
Elementary Occupations	7.20	6.88	7.16	7.37	7.54	9.59
Female						
Managers & Senior Officials	14.29	13.43	14.12	14.71	15.23	13.40
Professional Occupations	15.46	14.88	15.35	15.76	16.11	8.27
Associate Pro. & Technical	11.73	11.15	11.79	11.81	12.46	11.75
Administrative & Secretarial	8.79	8.34	8.73	9.03	9.38	12.47
Skilled Trades Occupations	6.90	6.61	6.85	7.12	7.23	9.38
Personal Service Occupations	6.95	6.53	6.97	7.20	7.28	11.49
Sales & Customer Service	6.76	6.50	6.69	6.94	7.07	8.77
Process, Plant & Machine	6.71	6.28	6.75	6.98	7.17	14.17
Elementary Occupations	6.02	5.73	5.89	6.21	6.31	10.12

Notes: % change is the percentage change in mean hourly earnings between 2004 and 2007.

Table 3.9

Mean Hourly Earnings by Industry

	2004-	2004	2005	2006	2007	%
Full Sample						
Agriculture & Fishing	8.03	6.98	7.31	8.46	9.07	29.94
Energy & Water	13.89	13.33	13.58	13.95	14.84	11.33
Manufacturing	11.42	10.80	11.19	11.89	12.17	12.69
Construction	11.20	10.67	10.91	11.62	11.77	10.31
Distribution, Hotels & Rest.	8.78	8.41	8.70	8.98	9.20	9.39
Transport & Communication	10.93	10.37	10.91	11.24	11.59	11.76
Banking, Finance & Insurance	14.54	13.87	14.20	14.88	15.47	11.54
Public Administration	12.19	11.68	12.04	12.53	12.77	9.33
Other Services	10.28	9.75	10.07	10.68	10.86	11.38
Male						
Agriculture & Fishing	7.96	6.95	7.59	8.27	8.98	29.21
Energy & Water	14.45	13.82	13.93	14.68	15.49	12.08
Manufacturing	11.79	11.19	11.61	12.19	12.54	12.06
Construction	11.30	10.79	11.02	11.70	11.85	9.82
Distribution, Hotels & Rest.	9.44	9.04	9.37	9.67	9.88	9.29
Transport & Communication	11.12	10.54	11.05	11.45	11.81	12.05
Banking, Finance & Insurance	16.22	15.62	15.85	16.59	17.01	8.90
Public Administration	13.72	13.19	13.46	14.21	14.30	8.42
Other Services	11.17	10.63	10.73	11.34	12.14	14.21
Female						
Agriculture & Fishing	8.28	7.08	6.24	9.19	9.39	32.63
Energy & Water	11.60	11.06	12.06	10.99	12.45	12.57
Manufacturing	10.13	9.39	9.70	10.83	10.93	16.40
Construction	10.31	9.61	9.93	10.91	11.03	14.78
Distribution, Hotels & Rest.	7.73	7.39	7.68	7.91	8.11	9.74
Transport & Communication	10.26	9.69	10.41	10.53	10.79	11.35
Banking, Finance & Insurance	12.07	11.34	11.83	12.30	13.15	15.96
Public Administration	11.22	10.68	11.14	11.50	11.83	10.77
Other Services	9.05	8.53	9.14	9.75	9.13	7.03

Notes: % change is the percentage change in mean hourly earnings between 2004 and 2007.

lowest earnings growth for men, but women have seen a large growth in earnings of 15.96%, although the banking, finance and insurance sector has been had the largest earnings in all years for both men and women.

Finally, table 3.10 disaggregates between public and private sector employment. Those employed in the public sector enjoy an earnings advantage over those in private sector employment (£12.59 to £11.37). This earnings advantage remains for both males and females. With regards to hourly earnings growth over the sample period, those in the private sector have experienced slightly higher earnings growth (11.07% to 10.76%). The gap in earnings growth is larger for women (12.78% to 11.74%) than for men (10.70% to 10.18%).

Table 3.10

Mean Hourly Earnings by Employment Sector

	2004-2007	2004	2005	2006	2007	% Change
Full Sample						
Private	11.37	10.84	11.17	11.66	12.04	11.07
Public	12.59	11.99	12.44	13.00	13.28	10.76
Male						
Private	12.13	11.59	11.93	12.43	12.83	10.70
Public	13.56	12.97	13.28	14.04	14.29	10.18
Female						
Private	9.85	9.31	9.67	10.12	10.50	12.78
Public	11.79	11.16	11.74	12.15	12.47	11.74

Notes: % change is the percentage change in mean hourly earnings between 2004 and 2007.

3.4 Results

In this section, I present, analyse and discuss results obtained from regressions of log hourly pay upon local unemployment. As noted in the methodology section, each specification is repeated, once with the house price variable included, and once with it omitted. Those regressions containing the house price variable have omitted the Scottish section of the sample, as house price data was not available for Scotland. Before focusing on the effects on unemployment on earnings, I present a full set of results from specifications (1) and (2).

Full results of specifications (1) and (2) reveal that the unemployment elasticity of earnings is initially -.04122, but falls to insignificance once the house price variable is added (for unemployment rate at NUTS 1 level). This is due to the inclusion of house prices 'mopping up' much of the regional variation that may have been attributed to the unemployment rate. The unemployment elasticity will be focused on throughout the results section; for now I will comment on the wider results. The population density variable is positive, suggesting that earnings increase with agglomeration. The coefficient on the rural dummy is also positive in specification (1), but this becomes negative after the introduction of the house price variable. Returns are positive to men, size of employer, public sector employment and intermediate/higher qualifications. Negative returns are found for marriage (a result found by Johnes, 2007, in his study of the wage curve). Relative to the omitted group of banking, finance and insurance, returns are negative for other industry sectors. I will now turn my attention to the unemployment elasticity of earnings.

Region

Table 3.12 presents unemployment elasticities for the sample as a whole (not disaggregated by gender) and for regions from specification (1). The regions in rows

Table 3.11

Full Regression Results for Specifications (1) and (2)

	Specification (1)		Specification (2)	
	Coeff.	t stat	Coeff.	t stat
Log Unemployment Rate	-.04122***	7.44	-.00293	0.50
Log Population Density	.02225***	22.97	.00706***	6.10
House Price	-	-	.24818***	87.65
Rural	.02217***	5.95	-.03743***	8.95
Male	.13496***	61.71	.13442***	57.84
Age	.06792***	112.39	.06803***	105.44
Age^2	-.00078***	105.18	-.00078***	99.38
Public	.01529***	4.39	.02318***	6.16
Job Tenure	.00971***	74.58	.0098***	70.10
Health Limit	-.08997***	25.92	-.08467***	22.86
Married	-.08059***	35.14	-.08334***	34.20
Plant Size				
25 to 49	.06752***	20.66	.07093***	20.24
50 to 499	.10277***	40.51	.10594***	39.14
500 and over	.17741***	57.90	.18085***	55.55
Ethnicity				
White	.04446***	4.09	.09546***	8.76
Mixed	.06764***	3.93	.08204***	4.73
Asian	-.02318*	1.90	.0068	0.56
Black	-.01922	1.43	-.01516	1.13
Chinese	-.01326	0.61	.00221	0.10
Industry				
Agriculture & Fishing	-.39126***	33.10	-.37481***	28.35
Energy & Water	-.0532***	6.52	-.06737***	7.11
Manufacturing	-.19785***	56.36	-.16973***	45.66
Construction	-.11467***	24.50	-.08718***	17.28
Distribution, Hotels & Rest.	-.28792***	78.16	-.26909***	69.14
Transport & Comms.	-.20151***	45.79	-.1872***	40.40
Public Administration	-.18712***	46.47	-.17187***	39.87
Other Services	-.26914***	49.46	-.26099***	45.04
Qualifications				
PhD	.58273***	58.57	.54446***	51.70
Masters	.55552***	93.07	.50776***	79.98
PGCE	.51379***	62.66	.48588***	56.35
First Degree	.44013***	110.91	.40792***	95.97

Higher Education	.25294***	60.17	.25805***	56.14
A Level	.09847***	27.50	.10549***	27.33
GCSE	.00078	0.21	.00894**	2.28
Other	-.06055***	14.46	-.06107***	13.81
Year				
2005	.04316***	15.77	.03804***	13.00
2006	.07901***	28.11	.07292***	24.08
2007	.10343***	37.24	.09378***	31.29
Constant	.37721***	14.79	.32052***	11.48

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions.

Table 3.12

Wage Flexibility by Region (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	-.04122***	-.06915***	-.11031***	-.12211***	-.04275***
	(7.44)	(16.40)	(30.82)	(38.41)	(13.60)
East	-	.29592***	-.12867***	-.12867***	.0921***
	-	(4.93)	(6.65)	(6.65)	(7.64)
East Midlands	-	-.12965***	-.10556***	-.09424***	-.04109***
	-	(3.53)	(7.45)	(6.61)	(2.95)
London	-	.10947***	-.07041***	-.09747***	.0739
	-	(3.05)	(3.20)	(7.23)	(1.56)
North East	-	-.00488	-.00002	-.0357**	-.00816
	-	(0.06)	(0.00)	(2.43)	(0.49)
North West	-	-.05332***	-.07556***	-.10611***	.0175
	-	(3.22)	(4.16)	(9.67)	(1.29)
Scotland	-	-.04464***	-.04581***	-.09135***	-.04052***
	-	(3.00)	(4.72)	(10.55)	(4.70)
South East	-	-.18642***	-.13235***	-.15071***	-.00764
	-	(5.97)	(9.84)	(12.94)	(0.66)
South West	-	-.20379***	-.10865***	-.07789***	-.03279***
	-	(7.29)	(6.97)	(5.99)	(3.23)
Wales	-	-.27559***	-.05712***	-.07903***	-.03373***
	-	(9.11)	(4.35)	(7.44)	(3.45)
West Midlands	-	.08611***	.00192	-.004	.04225***
	-	(5.82)	(0.13)	(0.29)	(3.96)
Yorkshire	-	-.02928*	-.06732***	-.05721***	-.0377***
	-	(1.75)	(4.27)	(4.02)	(3.09)
London & SE	.23551***	.18792***	.03316***	-.04935***	.1046***
	(20.78)	(18.34)	(3.45)	(6.06)	(10.76)
Rest England	-.18527***	-.09409***	-.10598***	-.09983***	-.02284***
	(22.54)	(16.53)	(21.17)	(22.25)	(5.60)
Rest UK	-.19506***	-.11186***	-.10354***	-.10633***	-.03933***
	(26.39)	(23.42)	(26.79)	(30.51)	(11.95)
North	-.07952***	-.05405***	-.06978***	-.08461***	-.02765***
	(5.75)	(9.15)	(15.20)	(20.97)	(6.93)
South	.29489***	.22218***	.06138***	.00019	.11019***
	(33.81)	(28.59)	(8.85)	(0.03)	(19.30)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by region two to twelve are NUTS 1 regions and the remainder are NUTS 1 regions aggregated into larger areas of interest.[29] The house price variable is omitted. Focusing on the top row, all unemployment elasticities are negative and significant for the different levels of unemployment rate aggregation used. However, the magnitude of the elasticity varies wildly. At the NUTS 1 level of aggregation, unemployment elasticity is -.04122, but this rises as disaggregation increases, reaching -.12211 at unitary authority level, before falling back to -.04275 at TTWA level. These figures are comparable to elasticities obtained by previous studies of the UK wage curve, and fit reasonably well with Blanchflower and Oswald's suggested elasticity of -.1 and Nijkamp and Poot's publication bias adjusted elasticity of -.07.

This result of wage flexibility being U shaped in the level of centralization has been previously identified by Groth and Johansson (2004), although using differing methodology. Groth and Johansson's model links wage flexibility and wage bargaining centralization together via contract duration. They find, as here, that wages are more flexible under intermediate centralization systems than for centralized or decentralized systems, as contracts are shorter. Groth and Johansson split contracting costs into a fixed menu cost and a variable co-ordination cost, finding that, as co-ordination costs are convex in the degree of centralization, a sufficiently large fixed cost causes the U shaped wage flexibility they encounter. This fits with the results of table 3.12, as wage flexibility at intermediate levels of centralization (especially NUTS 3 and UA levels) exceed those at the extremes of NUTS 1 and TTWA.

Whilst I am unaware of other studies that examine the unemployment elasticity of earnings using several levels of unemployment rate, Baltagi et al. (2008) enter the German unemployment rate at a highly disaggregated level (326 areas). They report

29 London and SE is restricted to London and South East England; Rest of England is made up of East England, East Midlands, North East, North West, South West, West Midlands and Yorkshire; Rest of UK is the same as Rest of England, but additionally including Wales and Scotland; South of the UK consists of London, the East, South East and South West; North of the UK includes East Midlands, North East, North West, Scotland, Wales, West Midlands and Yorkshire.

a short-run elasticity of -.016 and a long-run elasticity of -.037, which are small in comparison to the majority of elasticities reported in the literature.

Rows two to twelve present the unemployment elasticities found when restricting the sample to individual NUTS 1 regions. There are no elasticities reported for the NUTS 1 level unemployment rate, as there would be little variation in the unemployment rate within each of the NUTS 1 regions. When restricted to singular NUTS 1 regions, the reported unemployment elasticities show large variation. Considering the NUTS 2 level of aggregation first, significant and negative elasticities are found for seven of the eleven NUTS 1 regions, the largest for Wales, the South East and the South West. Only the North East exhibits an insignificant unemployment elasticity. The remaining three regions (the East, London and West Midlands) display significant and positive elasticities. These positive elasticities and the extremely large magnitude of some of the negative elasticities may be due to the low number of NUTS 2 regions found within each of the NUTS 1 regions distorting results. There are 36 NUTS 2 regions that are split between eleven NUTS 1 regions. The distribution of these regions is shown below:

Table 3.13

Number of NUTS 2 Regions in each NUTS 1 Region

NUTS 1 Region	Number of NUTS 2 Regions
East	3
East Midlands	3
London	2
North East	2
North West	5
Scotland	4
South East	4
South West	4
Wales	2
West Midlands	3
Yorkshire	4

Table 3.13 confirms the concern that there is insufficient variation causing some of the more suspect results encountered in table 3.12. Indeed, the North East which returned insignificant results contains only 2 NUTS 2 regions. Of the NUTS 1 regions that produced positive elasticities, London also has just two NUTS 2 regions, whilst the East of England and the West Midlands consist of three NUTS 2 regions each. Wales proves to be an anomaly, as it returns a significant and negative coefficient (-.27559), but is also made up of only 2 NUTS 2 regions. However, the size of this coefficient seems infeasible. Due to these concerns, results from regressions with minimal variation in the unemployment rate should be interpreted with care.

Examining column 3 of table 3.12, unemployment elasticities at NUTS 3 level, nine of the eleven NUTS 1 regions report significant and negative elasticities. The remaining two regions (the North East and West Midlands) do not exhibit a significant result. By increasing the level of disaggregation in the unemployment rate, the previous problems of positive or unfeasibly large negative elasticities has been eliminated. The areas reporting the largest elasticities are the South East and the East (-.13235 and -.12867).

Column 4 increases the level of disaggregation of the unemployment rate further, to unitary authority level. Now, ten of the eleven NUTS 1 regions exhibit significant negative unemployment elasticity, with only the West Midlands failing to display a significant elasticity. In terms of magnitude, the South East and the East are once again the largest (-.15071 and -.12867).[30] At this level of disaggregation, Wales has an unemployment elasticity of -.07903, which is close to the elasticity of -.09161 obtained in the previous chapter using a different dataset and a different set of controls.

[30] Elasticities for the East are the same for NUTS 3 and unitary authority level, as geographies are the same, just with a split in Bedfordshire.

Finally, results from the highest level of disaggregation, TTWA level, are shown in the final column of table 3.12. When running regressions for the sample as a whole, the magnitude of the elasticity falls to less than half its previous value, at -.04275. The results for individual NUTS 1 regions at this level of disaggregation are less uniform than at the previous two unemployment rates. At TTWA unemployment rate level, only five of the eleven NUTS 1 regions display negative and significant unemployment elasticity. As the magnitude of the elasticity for the sample as a whole has fallen, so has the magnitude of the individual regional elasticities. Of the remaining six NUTS 1 regions, two have significant and positive elasticities (East of England and West Midlands, both of which had positive elasticities at NUTS 2 level), whilst four (London, North East, North West and South East) fail to display a significant coefficient.

The final five rows of table 3.12 give unemployment elasticities for areas of interest aggregated from the NUTS 1 regions. London and the South East of England report a positive elasticity for all unemployment rates up to and including NUTS 3 level and at TTWA level, with a negative elasticity at unitary authority level. A similar pattern is found for the South of the UK, with positive elasticities at all levels of aggregation except for unitary authority (which is insignificant). It is possible that these results are distorted by a London effect (which is controlled for by the use of regional/London dummy variables in Table 3.14).

The remaining three areas of interest (the rest of England, rest of the UK and North of the UK) display significant negative unemployment elasticities at all unemployment rate levels. The previously discussed problems at NUTS 1 level are present, with very large negative elasticities reported, particularly for the rest of England and the rest of the UK. At levels of disaggregation higher than NUTS 1 level, the reported elasticities are similar to those found for the sample as a whole. The removal of the London (and South East) areas suggests that distortion from London is not the cause of the fall in elasticity at TTWA level.

Table 3.14 reports unemployment elasticities for the sample as a whole and for the five areas of interest detailed above, with dummy variables for NUTS 1 regions inserted. Due to the insertion of these dummy variables, elasticities at NUTS 1 level must be interpreted with caution, due to most of the variation in unemployment rate being controlled for via the regional dummies. Most results are insignificant, except for the South of the UK and London and the South East, which report large, positive elasticities. Results at NUTS 2 level and above are of greater interest. As seen in the previous section, there appear to be two sets of behaviour: one belonging to the Southern areas (the South of the UK and London and the South East) and another to the more Northern areas (the North of the UK, the rest of England and the rest of the UK). The Northern areas tend to behave in much the same way as the sample as a whole. In comparison to the previous set of results (without regional dummies), as expected, the coefficients have decreased in magnitude, due to the additional controls. For the sample as a whole, elasticity increases in magnitude, until reaching -.08318 at unitary authority level and then falling to insignificance at TTWA level.[31] Similar results are found for the Northern areas, although the rest of England posts a positive coefficient at TTWA level. The South of the UK and London and the South East both show significant and negative unemployment elasticities (between -.08612 and -.09926) at NUTS 3 and unitary authority level, whilst London and the South East fails to reach significance at TTWA level. This supports my earlier concern that a London effect was dominating and distorting results in these restricted regressions (which has now been controlled for).

Table 3.15 introduces the house price variable with specification (2). It is hoped that the house price variable will control for a wide variety of regional differences in non-price amenities (Roback, 1982, and Blackaby and Murphy, 1990), along with earnings differences between areas. The methodology is based on that found in Blackaby, Bladen-Howell and Symons (1991), where the average house price in each unitary authority is calculated, then the deviations away from the national average house price is entered into the model at unitary authority level.

[31] Dummy variables at unitary authority level were also tested, but caused all unemployment elasticities to become statistically insignificant.

Table 3.14

Wage Flexibility by Aggregated Regions (NUTS 1 Dummies Included, House Price Variable Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	.00536	-.02499***	-.06817***	-.08318***	-.00558
	(0.27)	(4.34)	(16.21)	(23.24)	(1.59)
London & SE	.21364***	.05424***	-.08612***	-.0943***	.00445
	(3.32)	(3.16)	(7.81)	(11.32)	(0.39)
Rest England	-.03586	-.01983***	-.0752***	-.07634***	.00799*
	(0.81)	(2.73)	(12.94)	(15.15)	(1.77)
Rest UK	-.02961	-.04067***	-.06712***	-.080603***	-.00725**
	(1.42)	(6.72)	(14.85)	(20.44)	(2.00)
North	-.02869	-.03334***	-.05608***	-.0764***	-.01621***
	(1.34)	(5.27)	(11.40)	(17.87)	(3.91)
South	.15976***	.00833	-.09926***	-.09559***	.01835***
	(3.22)	(0.60)	(12.23)	(14.66)	(2.84)

Notes: unemployment elasticities reported from specification (3); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions.

Table 3.15

Wage Flexibility by Region (House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	-.00293	-.01771***	-.02509***	-.0311***	.00674*
	(0.50)	(3.85)	(6.05)	(8.37)	(1.94)
East	-	.10049*	-.0267	-.0267	.02938**
	-	(1.68)	(1.35)	(1.35)	(2.38)
East Midlands	-	-.03187	-.04729***	-.04666***	-.00378
	-	(0.84)	(3.00)	(3.08)	(0.26)
London	-	.06539*	.01653	-.03241**	.15737***
	-	(1.82)	(0.71)	(2.13)	(3.29)
North East	-	-.19926**	.00612	-.02052	.01179
	-	(2.36)	(0.34)	(1.37)	(0.70)
North West	-	-.01967	-.00677	-.03964***	.01927
	-	(1.18)	(0.36)	(3.23)	(1.43)
Scotland	-	-	-	-	-
	-	-	-	-	-
South East	-	-.01167	-.03398**	-.04706***	-.00674
	-	(0.37)	(2.44)	(3.78)	(0.59)
South West	-	-.17413***	-.08476***	-.05893***	-.02174**
	-	(6.07)	(5.03)	(4.31)	(2.11)
Wales	-	-.09826**	-.00994	-.03673***	-.01171
	-	(2.24)	(0.71)	(3.10)	(1.17)
West Midlands	-	-.00554	-.01586	-.012	.00004
	-	(0.35)	(1.06)	(0.87)	(0.00)
Yorkshire	-	.08195***	-.00732	-.00943	.00523
	-	(3.64)	(0.37)	(0.56)	(0.37)
London & SE	.14755***	.08479***	.02499***	-.01642**	.06929***
	(12.52)	(7.72)	(2.63)	(2.02)	(7.15)
Rest England	-.00223	.01241**	-.00813	-.01474***	.02292***
	(0.23)	(1.99)	(1.45)	(2.94)	(5.49)
Rest UK	-.0073	.00473	-.01388***	-.02122***	.01535***
	(0.78)	(0.78)	(2.73)	(4.67)	(4.03)
North	-.06374***	.00042	-.02828***	-.03596***	.00061
	(3.85)	(0.06)	(4.80)	(6.93)	(0.13)
South	.17305***	.09933***	.04273***	.01591***	.07151***
	(18.38)	(11.71)	(6.24)	(2.64)	(12.52)

Notes: unemployment elasticities reported from specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions.

The effect of including house prices as an explanatory variable is greatly decreased levels of elasticity. Mean house prices are able to explain such a large proportion of the variation in earnings between areas, that a large decrease in the magnitude of the unemployment elasticities was not unexpected. However, even with such large decreases in the magnitude of the unemployment elasticity, the previous finding of wage flexibility peaking over moderate levels of disaggregation (and therefore centralization) still holds. This method appears to better control for regional differences than the housing domain of the WIMD that was used in chapter two. Looking at the sample as a whole, an insignificant result is found at the NUTS 1 level and a small positive elasticity is found for the TTWA level. At moderate levels of centralization, unemployment elasticity is found to be between -.01771 and -.0311. Due to the decreases in the magnitude of the elasticities, results for individual NUTS 1 regions would be considered somewhat erratic.[32] As previously mentioned, results at NUTS 2 level are affected by the low variation in unemployment rates when constrained to individual NUTS 1 regions. Due to the inclusion of the house price variable controlling for much of the regional variation, results at NUTS 3 level are not as strong as in the house price free specification. Only results for three NUTS 1 regions are significant and display the expected negative coefficient (East Midlands, South East and South West). The remainder fail to display significant results. Results are somewhat improved when increasing the level of disaggregation to unitary authority level, with six of the ten NUTS 1 regions experiencing significant negative unemployment elasticity. Due to the effect of adding a house price variable greatly diminishing the magnitude of the unemployment elasticity coefficients, the results at TTWA level (which are increasing in wage rigidity, as set out previously) don't offer much in the way of compelling evidence in support of the wage curve. As can be seen in the case of the sample as a whole, at TTWA level, results are insignificant or positive. This finding is repeated for NUTS 1 regions, with only three posting significant results: one negative (the South West) and two positive (London and the East). This result may seem somewhat disappointing, but knowing that wages become more rigid at high levels of decentralization and that the addition of a variable representing house prices will control for a large portion of the variation between regions, the largely insignificant result is not wholly surprising.

32 Due to house price data being unavailable for Scotland, there are no results for Scotland.

Focusing on the lower portions of table 3.15, results for the South of the UK and London and the South East are similar to those presented in table 3.14, only with the magnitude greatly decreased due to the presence of the house price variable. Results for the remaining three areas of interest are also similar to those in table 3.15, but the addition of the house price variable has caused several of the coefficients to become either positive or insignificant.

There is not an appreciable improvement in the full sample results when adding regional dummies to the specification (table 3.16). For the sample as a whole, elasticities at NUTS 2, NUTS 3 and unitary authority levels remain significant and negative, but the coefficient on NUTS 1 unemployment has become positive. Results for the rest of England and the rest of the UK again remain largely the same, with a small increase in magnitude. Results for the North of the UK appear to have deteriorated (in respect to the expected wage curve result). Without controlling for house price variation, negative elasticities were found at NUTS 1, NUTS 3 and unitary authority levels of disaggregation.[33] However, after inserting regional dummies into the specification, significant negative elasticities are found only at NUTS 3 and unitary authority level (positive elasticities are found at NUTS 2 and TTWA level). Conversely, results for the South of the UK and London and the South East have benefited by the inclusion of regional dummy variables. Without regional dummies, elasticities were found to be primarily positive, which would be unexpected according to previous wage curve literature (instead supporting the theory of compensating differentials). With regional dummies, at the three intermediate levels of centralization, the South of the UK and London and the South East exhibit the expected negative unemployment elasticities. That the South of the UK and London and the South East only display the expected negative sign on the unemployment coefficient when regional dummies are included may mean that the NUTS 1 dummies are controlling for a London based effect, distorting results due to the differences between the regional economy of the capital and the regional

33 Although due to the low level of variation when the sample is geographically restricted, results at NUTS 1 level of disaggregation may be considered unreliable.

Table 3.16

Wage Flexibility by Aggregated Regions (NUTS 1 Dummies Included, House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	.12564***	-.01264**	-.03345***	-.0416***	.01072***
	(4.12)	(1.96)	(6.92)	(10.13)	(2.76)
London & SE	.26638***	-.04442**	-.04562***	-.04981***	.01532
	(4.17)	(2.54)	(4.12)	(5.86)	(1.37)
Rest England	-.06161	.00987	-.02578***	-.02959***	.01406***
	(1.41)	(1.35)	(4.28)	(5.61)	(3.13)
Rest UK	-.02227	.0078	-.02175***	-.02913***	.01103***
	(0.55)	(1.11)	(3.95)	(6.09)	(2.70)
North	-.00541	.02113***	-.01261**	-.0251***	.01053**
	(0.13)	(2.78)	(2.01)	(4.63)	(2.14)
South	.21551***	-.06604***	-.05526***	-.05192***	.01837***
	(4.38)	(4.72)	(6.74)	(7.80)	(2.87)

Notes: unemployment elasticities reported from specification (4); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions.

economies of the surrounding areas. After controlling for regional differences via the NUTS 1 dummies, significant negative elasticities are displayed.

To better understand the results examined thus far, the sample can be split by gender. The results for males are presented in table 3.17. The house price variable is not included. When the sample is restricted to males, results are very similar to the results obtained for the sample as a whole, albeit with increased magnitude. Without the house price variable, elasticities between the NUTS 1 and unitary authority level of disaggregation are between -.11877 and -.12877, reducing to -.06031 at TTWA level. A difference to the sample as a whole is that elasticity at NUTS 1 level is greater, which reduces support for Groth and Johansson's (2004) model that suggests wage flexibility will be U-shaped in centralization. Elasticities of NUTS 1 regions and areas of interest are again very similar to results for the sample as a whole, with small variations in the magnitude of the elasticities.

The addition of the house price variable reduces the magnitude of the elasticities, as seen in previous regressions, but again, results are similar to those seen for the sample as a whole (table 3.18). These findings are confirmed when adding NUTS 1 region dummies to the specification (results for specifications 3 and 4 available in appendix). Results, when limited to females, appear weaker than those obtained for the sample as a whole and for men only. The findings are given in tables 3.19 and 3.20 .

Only at NUTS 3 and unitary authority level do females exhibit significant and negative unemployment elasticity (at -.03459 and -.05029). Several previous studies have failed to find a significant wage curve for females (Pannenberg and Schwarze, 1998, and Collier, 2000). These smaller coefficients would suggest that the wages of females are less responsive to the local unemployment rate than the wages of males. A large, positive elasticity is found for women at NUTS 1 level (with a smaller positive elasticity at NUTS 2 level). When combined with the large negative elasticity found for men at this level, a small, negative elasticity for the sample as a

Table 3.17

Wage Flexibility by Region (Males Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	-.12877***	-.11877***	-.12527***	-.12608***	-.06031***
	(19.10)	(23.39)	(29.89)	(35.01)	(16.79)
East	-	-.07539	-.16291***	-.16204***	.037**
	-	(1.14)	(6.74)	(6.74)	(2.46)
East Midlands	-	-.04713	-.10004***	-.07406***	-.0337**
	-	(1.15)	(5.62)	(4.53)	(2.14)
London	-	.13538**	-.08665***	-.08826***	.10815*
	-	(2.56)	(3.21)	(6.23)	(1.75)
North East	-	-.21998	.03945*	-.00304	.04829**
	-	(1.22)	(1.83)	(0.17)	(2.40)
North West	-	-.05352***	-.05773***	-.07228***	.01126
	-	(2.61)	(2.69)	(5.50)	(0.78)
Scotland	-	-.06899***	-.02661**	-.06605***	-.02224**
	-	(3.74)	(2.25)	(7.27)	(2.28)
South East	-	-.28068***	-.10513***	-.13982***	-.00596
	-	(6.90)	(6.44)	(10.25)	(0.43)
South West	-	-.17922***	-.09436***	-.0838***	-.0353***
	-	(5.75)	(6.16)	(5.95)	(3.41)
Wales	-	-.32131***	-.06616***	-.08954***	-.03184***
	-	(8.78)	(4.16)	(7.24)	(2.77)
West Midlands	-	.11072***	.016	.00036	.04513***
	-	(5.96)	(0.89)	(0.02)	(3.38)
Yorkshire	-	-.00677	-.04846**	-.0345**	-.01949
	-	(0.36)	(2.37)	(1.97)	(1.40)
London & SE	.20428***	.14877***	-.00128	-.07446***	.06734***
	(13.28)	(10.60)	(0.10)	(7.94)	(5.50)
Rest England	-.18892***	-.09741***	-.10099***	-.09114***	-.03199***
	(19.54)	(14.42)	(17.41)	(17.49)	(6.92)
Rest UK	-.19807***	-.11972***	-.09935***	-.09708***	-.04363***
	(23.06)	(21.21)	(22.07)	(24.47)	(11.69)
North	-.07875***	-.05734***	-.05941***	-.06998***	-.02143***
	(4.86)	(8.14)	(10.86)	(15.25)	(4.70)
South	.26494***	.17085***	.01267	-.04331***	.06384***
	(21.50)	(16.00)	(1.49)	(6.04)	(9.40)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions; restricted to men.

Table 3.18

Wage Flexibility by Region (Males Only, House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	-.0396***	-.04005***	-.04119***	-.04519***	-.01011**
	(5.40)	(7.03)	(8.31)	(10.45)	(2.51)
East	-	-.07929	-.04274*	-.04377*	-.02529*
	-	(1.22)	(1.70)	(1.75)	(1.65)
East Midlands	-	.00879	-.05657***	-.03425**	-.0156
	-	(0.21)	(3.03)	(2.00)	(0.99)
London	-	.0793	-.01567	-.04505***	.1849***
	-	(1.50)	(0.56)	(2.96)	(2.98)
North East	-	-.39217**	.04515**	.00741	.05995***
	-	(2.14)	(2.10)	(0.42)	(2.96)
North West	-	-.03001	-.00456	-.02505*	.01096
	-	(1.46)	(0.21)	(1.79)	(0.76)
Scotland	-	-	-	-	-
	-	-	-	-	-
South East	-	-.08028*	-.03824**	-.07071***	-.01569
	-	(1.92)	(2.30)	(4.99)	(1.16)
South West	-	-.15138***	-.07246***	-.06403***	-.02636**
	-	(4.78)	(4.45)	(4.30)	(2.52)
Wales	-	-.15859***	-.01726	-.04926***	-.00848
	-	(2.91)	(1.02)	(3.59)	(0.72)
West Midlands	-	.01157	-.02336	-.02504	-.00744
	-	(0.57)	(1.30)	(1.52)	(0.54)
Yorkshire	-	.06047**	-.01262	-.00891	.00108
	-	(2.55)	(0.54)	(0.47)	(0.07)
London & SE	.11526***	.04719***	-.00618	-.0465***	.04006***
	(7.22)	(3.18)	(0.51)	(4.96)	(3.29)
Rest England	-.01805	.00413	-.01469**	-.01708***	.00738
	(1.58)	(0.55)	(2.27)	(2.96)	(1.56)
Rest UK	-.01905*	-.0057	-.02082***	-.02545***	.00223
	(1.72)	(0.79)	(3.53)	(4.88)	(0.51)
North	-.03208*	.00294	-.02464***	-.03042***	-.0001
	(1.68)	(0.35)	(3.54)	(5.12)	(0.02)
South	.12974***	.04559***	.00445	-.02165***	.03305***
	(9.81)	(3.99)	(0.53)	(3.05)	(4.88)

Notes: unemployment elasticities reported from specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions; restricted to men.

Table 3.19

Wage Flexibility by Region (Females Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	.11314***	.02867***	-.03459***	-.05029***	.00481
	(13.36)	(4.57)	(6.80)	(11.35)	(1.12)
East	-	.5785***	-.04105*	-04105*	.10006***
	-	(7.70)	(1.76)	(1.76)	(6.07)
East Midlands	-	-.15151***	-.07024***	-.06713***	-.01797
	-	(2.86)	(3.88)	(3.53)	(1.08)
London	-	.07644	-.03548	-.03786**	.06178
	-	(1.63)	(1.19)	(2.31)	(0.92)
North East	-	.08717	-.01619	-.03111*	-.03188
	-	(1.18)	(0.60)	(1.65)	(1.51)
North West	-	-.03093	-.03959*	-.07133***	.00099
	-	(1.33)	(1.73)	(5.47)	(0.07)
Scotland	-	-.00481	-.04792***	-.07823***	-.04657***
	-	(0.24)	(3.77)	(6.23)	(3.98)
South East	-	-.03328	-.11487***	-.11244***	-.00925
	-	(0.91)	(6.72)	(7.29)	(0.67)
South West	-	-.08944**	-.03527	-.02135	-.00713
	-	(2.27)	(1.41)	(1.25)	(0.51)
Wales	-	-.17287***	-.0186	-.02369	-.03304**
	-	(3.20)	(1.04)	(1.63)	(2.43)
West Midlands	-	.01355	-.00829	-.00942	.02742*
	-	(0.64)	(0.42)	(0.52)	(1.66)
Yorkshire	-	-.08057***	-.04869***	-.04165**	-.04665***
	-	(3.43)	(2.78)	(2.57)	(3.27)
London & SE	.26121***	.20573***	.05472***	-.00249	.09479***
	(16.14)	(14.85)	(4.48)	(0.24)	(8.07)
Rest England	-.13769***	-.05814***	-.05552***	-.05246***	-.00085
	(10.17)	(6.77)	(7.95)	(8.85)	(0.16)
Rest UK	-.14175***	-.06684***	-.0606***	-.06108***	-.0173***
	(11.50)	(9.17)	(10.96)	(12.59)	(3.83)
North	-.03742*	-.03986***	-.0495***	-.05622***	-.02624***
	(1.79)	(4.60)	(7.90)	(10.30)	(4.96)
South	.29673***	.23898***	.09386***	.04228***	.10774***
	(25.40)	(23.55)	(10.46)	(5.46)	(14.77)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions; restricted to women.

whole is found, prompting the U-shape in the full sample unemployment elasticity. Groth and Johansson do not disaggregate by gender in their study, but my research points to the U-shape in wage flexibility being influenced by the gender composition. Making comparisons between genders at a regional level, it can be seen that there are large differences in unemployment elasticity between males and females. Several instances where unemployment elasticity is larger for women at NUTS 3 and unitary authority levels occur, for Scotland (at NUTS 3 and UA level), the South East (at NUTS 3 level) and Yorkshire (at NUTS 3 and UA levels), although these differences are small and statistically insignificant.[34]

When the house price variable is added to the specification, for males and the sample as a whole, large decreases in the magnitude of the unemployment elasticities are exhibited. When restricted to just females, this effect is far more prominent, primarily due to the already smaller unemployment elasticities (table 3.20). When looking at the UK as a whole, unemployment elasticity for females is significant (except at unitary authority level), however, it is positive.

When restricting the female sample to individual NUTS 1 regions, the majority do not display significant elasticities. Only three regions exhibit the expected negative elasticity: the South West and West Midlands (at NUTS 2 level) and Wales (at TTWA level). The addition of regional dummy variables to the female specification improves results slightly, with significant negative results found at NUTS 3 and unitary authority levels before the inclusion of the house price variable, and at unitary authority level thereafter (table 3.A6). When house prices are included, the magnitude of the unemployment elasticity is very small, at -.0168.

34 Due to concerns regarding the validity of results at the NUTS 2 level of disaggregation when restricting the sample to individual regions, we have not discussed any differences appearing at this level.

Table 3.20

Wage Flexibility by Region (Females Only, House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	.05755***	.02335***	.01059*	.00168	.02013***
	(6.53)	(3.49)	(1.89)	(0.35)	(4.40)
East	-	.3268***	-.00269	-.00269	.05573***
	-	(4.16)	(0.12)	(0.12)	(3.32)
East Midlands	-	-.04758	-.01673	-.02572	.01964
	-	(0.85)	(0.80)	(1.26)	(1.11)
London	-	.04884	.03373	-.002	.13132*
	-	(1.04)	(1.06)	(0.12)	(1.94)
North East	-	-.03594	-.01495	-.01895	-.01529
	-	(0.43)	(0.56)	(0.99)	(0.71)
North West	-	.00338	-.00127	-.02064	-.00431
	-	(0.14)	(0.06)	(1.45)	(0.32)
Scotland	-	-	-	-	-
	-	-	-	-	-
South East	-	.07908**	-.02061	-.00926	.00555
	-	(2.16)	(1.16)	(0.56)	(0.41)
South West	-	-.06883*	-.0176	-.01437	-.00251
	-	(1.70)	(0.67)	(0.83)	(0.18)
Wales	-	.03914	.00707	-.00039	-.02329*
	-	(0.52)	(0.38)	(0.03)	(1.70)
West Midlands	-	-.04631**	.00203	.00199	-.0034
	-	(2.08)	(0.10)	(0.11)	(0.20)
Yorkshire	-	.01821	.01677	.01491	-.00423
	-	(0.60)	(0.79)	(0.78)	(0.26)
London & SE	.18348***	.12101***	.04628***	.01356	.06925***
	(10.93)	(8.17)	(3.83)	(1.33)	(5.93)
Rest England	.02941**	.02453***	.01171	.00265	.02274***
	(1.96)	(2.70)	(1.58)	(0.42)	(4.18)
Rest UK	.01959	.02143**	.00767	.00017	.0154***
	(1.34)	(2.43)	(1.13)	(0.03)	(3.06)
North	-.05853**	-.00761	-.014*	-.01676**	-.00808
	(2.36)	(0.74)	(1.81)	(2.56)	(1.33)
South	.19987***	.14661***	.07041***	.041***	.07802***
	(15.87)	(13.23)	(7.92)	(5.38)	(10.71)

Notes: unemployment elasticities reported from specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by regions; restricted to women.

Rural/Urban Status

I have established that, using the APS between 2004 and 2007, the wages of men appear more responsive to changes in local unemployment. This result is in line with previous results in the literature (Card, 1995, Bell *et al.*, 2002, and Sanz-de-Galdeano and Turunen, 2006). However, these elasticities may vary due to other factors relating to personal characteristics or the worker's occupation. To further examine wage flexibility, I have disaggregated by factors relating to the individual's employment characteristics and have then calculated unemployment elasticities. Firstly, I disaggregate geographically by the rural/urban split.[35] Table 3.21 gives the resulting elasticities.

Regarding the sample as a whole, elasticities at all levels of the unemployment rate are negative and significant, but higher wage flexibility is found for rural areas at greater levels of centralization (NUTS 1 and NUTS 2), whilst at more decentralized levels (NUTS 3, unitary authority and TTWA) people living in urban areas are more sensitive to the local unemployment rate. It is possible that the size of the NUTS 1 and NUTS 2 elasticities for rural areas are biased, as some NUTS 1 areas are predominantly urban, reducing the variation for the rural sample at these levels of aggregation. The result of urban elasticities being greater than rural elasticities has previously been found by Turunen (1998). By splitting the sample by gender, an interesting result is uncovered: for men, results are similar to the main sample and living in an urban area results in larger elasticities than living in a rural area (except for at NUTS 2 level), but the opposite is true for women: those living in rural areas are more open to earnings change due to local unemployment rates than those in urban areas. In fact, women experience significant and positive elasticities in urban areas at the NUTS 1, NUTS 2 and TTWA levels. This may explain the large rural advantage at NUTS 1 and NUTS 2 levels for the sample as a whole.

35 Details of the rural/urban split variable are given in the methodology and data section.

Table 3.21

Wage Flexibility by Rural/Urban Status (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample					
Rural	-.12656***	-.1328***	-.09641***	-.11385***	-.03134***
	(6.82)	(11.70)	(10.18)	(11.38)	(5.17)
Urban	-.02774***	-.05752***	-.11187***	-.12223***	-.04782***
	(4.66)	(12.60)	(28.85)	(36.29)	(13.02)
Male					
Rural	-.11474***	-.1435***	-.09115***	-.11401***	-.03033***
	(5.32)	(10.32)	(7.97)	(10.16)	(4.27)
Urban	-.12672***	-.11224***	-.12915***	-.126***	-.07052***
	(17.34)	(20.42)	(28.49)	(32.96)	(16.93)
Female					
Rural	-.08034***	-.06396***	-.04855***	-.0523***	-.03837***
	(2.63)	(4.15)	(3.98)	(3.97)	(4.31)
Urban	.13316***	.04635***	-.03188***	-.0504***	.01722***
	(14.83)	(6.74)	(5.69)	(10.68)	(3.53)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by rural/urban status.

The addition of the house price variable (table 3.22) seems to affect elasticities for women more than for men. For men, greater (negative) wage flexibility is found in urban areas at all levels of unemployment rate disaggregation, except for unitary authority. For women, the effect of the house price variable has been to turn negative elasticities for rural areas either positive or insignificant. This large change in female results has an effect on the sample as a whole. The only significant result at NUTS 1 level is for rural areas and is positive, whilst no significant results are found at TTWA level for the sample as a whole. The greater negative elasticity at unitary authority level is found for rural areas (-.03768), whilst at NUTS 2 and NUTS 3 levels, the only significant elasticities are found for urban areas (both are negative).

Industry

Previous research has found the unemployment elasticity of earnings to vary by industry sector, with Blanchflower and Oswald (1994) finding construction, manufacturing, and banking, finance and insurance to have the greatest wage flexibility. Table 3.23 gives unemployment elasticities by industry sector with the house price variable omitted. It reveals several industries that have large wage flexibility, regardless of the level of unemployment rate disaggregation, primarily: manufacturing, energy and water, transport and communications, and distribution, hotels and restaurants. Construction, finance, and public administration, education and health also display a consistently significant and negative elasticity, albeit at a lower magnitude. Turunen (1998) reports large elasticities for construction and transport and communications The elasticity in the finance sector is sensitive to the level of unemployment rate used, suggesting that wages in this sector respond more to local unemployment (NUTS 3 and unitary authority). Only the earnings of those employed in agriculture and fishing appear to be insensitive to the unemployment rate. Table 3.24 adds the house price variable to the previous specification.

Table 3.22

Wage Flexibility by Rural/Urban Status (House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample					
Rural	.06605***	-.00107	-.02224	-.03768***	.00683
	(2.79)	(0.06)	(1.49)	(2.71)	(0.91)
Urban	-.00048	-.01566***	-.02286***	-.02801***	.00642
	(0.08)	(3.23)	(5.25)	(7.23)	(1.63)
Male					
Rural	.07457***	-.02073	-.03105*	-.04873***	-.00576
	(2.66)	(1.02)	(1.81)	(3.18)	(0.66)
Urban	-.04034***	-.03773***	-.03877***	-.04199***	-.01136*
	(5.20)	(6.26)	(7.43)	(9.27)	(2.49)
Female					
Rural	.07918**	.04549*	.01012	.00192	-.01237
	(2.15)	(1.77)	(0.57)	(0.11)	(1.14)
Urban	.06148***	.02394***	.01134*	.00251	.0279
	(6.63)	(3.37)	(1.90)	(0.50)	(5.48)

Notes: unemployment elasticities reported from specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by rural/urban status.

Table 3.23

Wage Flexibility by Industry Sector (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Agriculture & Fishing	.00695	-.03584	-.00028	-.00587	.01592
	(0.11)	(0.76)	(0.01)	(0.15)	(0.63)
Energy & Water	-.094**	-.13906***	-.09597***	-.09505***	-.03942*
	(2.08)	(4.35)	(3.68)	(4.06)	(1.70)
Manufacturing	-.15291***	-.12716***	-.14234***	-.14829***	-.06727***
	(11.41)	(13.20)	(18.09)	(20.96)	(9.71)
Construction	-.08397***	-.09779***	-.07745***	-.09251***	-.0368***
	(3.86)	(5.97)	(5.80)	(7.63)	(3.16)
Distribution, Hotels & Rest.	-.09861***	-.10368***	-.1275***	-.14101***	-.0629***
	(6.79)	(9.36)	(13.46)	(16.71)	(7.74)
Transport & Communications	-.13238***	-.13354***	-.14863***	-.14948***	-.07649***
	(6.93)	(9.03)	(11.78)	(13.34)	(6.69)
Finance	-.01035	-.05064***	-.16057***	-.1727***	-.04212***
	(0.69)	(4.22)	(15.05)	(18.79)	(4.39)
Public Admin, Educ. & Health	.0299***	-.01693**	-.05483***	-.06669***	-.01692***
	(3.30)	(2.47)	(9.45)	(12.92)	(3.32)
Other Services	.04458*	-.01607	-.09166***	-.10194***	-.04492***
	(1.64)	(0.76)	(5.00)	(6.29)	(2.81)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by industry sector.

Table 3.24

Wage Flexibility by Industry Sector (House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Agriculture & Fishing	-.01939	-.01867	.03844	.00222	.03317
	(0.25)	(0.31)	(0.73)	(0.05)	(1.11)
Energy & Water	-.02663	-.05493	-.00861	-.00705	.01037
	(0.55)	(1.45)	(0.26)	(0.24)	(0.39)
Manufacturing	-.0308**	-.02528**	-.03456***	-.0414***	.00102
	(2.18)	(2.41)	(3.80)	(5.03)	(0.13)
Construction	.00273	-.01059	.00487	.00208	.01062
	(0.11)	(0.56)	(0.30)	(0.14)	(0.79)
Distribution, Hotels & Rest.	-.04092***	-.03785***	-.03496***	-.04951***	-.00686
	(2.65)	(3.11)	(3.16)	(5.01)	(0.76)
Transport & Communications	-.08079***	-.06174***	-.05441***	-.05304***	-.01887
	(4.06)	(3.89)	(3.79)	(4.15)	(1.51)
Finance	-.02044	-.04103***	-.05301***	-.05081***	.0086
	(1.30)	(3.20)	(4.49)	(4.88)	(0.84)
Public Admin, Educ. & Health	.05632***	.0201***	.00423	-.00319	.01819***
	(5.84)	(2.64)	(0.62)	(0.52)	(3.17)
Other Services	.03221	-.01957	-.0317	-.02425	-.02027
	(1.09)	(0.84)	(1.49)	(1.28)	(1.13)

Notes: unemployment elasticities reported from specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by industry sector.

The addition of the house price variable has much the same effect as seen previously, reducing the magnitude and significance of the coefficients, due to the large amount of regional variation it is able to control for. Whilst energy and water and construction may have sported elasticities large in magnitude, their t-statistics were small relative to other industries, and the additional control exerted by the house price variable has caused the elasticities of these industries to become insignificant. The industries displaying the largest (negative) elasticities are manufacturing, distribution, hotels and restaurants, transport and communications and finance. Due to the house price variable exerting a fairly uniform effect, reducing magnitude and significance, tables of further specifications that include the house price variable will no longer be reported.

Table 3.25 gives elasticities by industry sector when the sample is restricted to just men. Whilst I have generally found the elasticities of males only to be highly similar to those for the sample as a whole, but at a larger magnitude, it is interesting to note that elasticities in several industries have fallen when restricting the sample to males. This is most notable for the energy and water industry (at NUTS 3 and UA level), and transport and communications (also at NUTS 3 and UA level) where earnings for men are less responsive to regional unemployment than for the sample as a whole. This would suggest that males in these industries are better protected from changes in the regional labour market than their female counterparts.

Comparison with table 3.26 (elasticities by industry sector restricted to females) reveals the energy and water industry to be an isolated case, as unemployment elasticities are found to be greater for women than for men, meaning that women in the energy and water industry have far less labour market protection than men. Further examination reveals no further industries (at any level of unemployment rate disaggregation) where female elasticity exceeds male elasticity. For females, the manufacturing and transport and communication industries post high levels of elasticity (at NUTS 3 and UA level), peaking at -.10525 for manufacturing and -.1202 for transport and communications. Elasticities in the remaining industries are of small magnitude in comparison to male elasticities, with a greater number of

Table 3.25

Wage Flexibility by Industry Sector (Males Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Agriculture & Fishing	.00748	-.04304	.00732	.0006	.04129
	(0.12)	(0.91)	(0.18)	(0.02)	(1.57)
Energy & Water	-.08176*	-.14208***	-.07673***	-.07419***	-.04561**
	(1.83)	(4.36)	(2.95)	(3.36)	(2.05)
Manufacturing	-.17852***	-.1394***	-.12886***	-.1289	-.06883***
	(13.04)	(14.17)	(16.38)	(18.75)	(10.33)
Construction	-.12885***	-.11668***	-.0889***	-.0956***	-.04388***
	(6.24)	(7.58)	(7.21)	(8.83)	(4.12)
Distribution, Hotels & Rest.	-.16365***	-.13653***	-.13464***	-.13615***	-.07001***
	(9.28)	(10.25)	(12.17)	(14.23)	(7.37)
Transport & Communications	-.20279***	-.15881***	-.13083***	-.12308***	-.07793***
	(10.24)	(10.56)	(10.40)	(11.29)	(7.00)
Finance	-.13309***	-.12879***	-.19101***	-.17966***	-.08213***
	(6.81)	(8.36)	(14.45)	(16.45)	(7.05)
Public Admin, Educ. & Health	-.03571***	-.05487***	-.077***	-.08102***	-.03296***
	(2.60)	(5.30)	(9.00)	(11.07)	(4.53)
Other Services	-.0632*	-.08511***	-.12924***	-.12696***	-.06972***
	(1.83)	(3.19)	(5.73)	(6.80)	(3.76)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by industry sector; restricted to men.

Table 3.26

Wage Flexibility by Industry Sector (Females Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Agriculture & Fishing	-.12335	.0604	-.03823	.0237	.05642
	(0.78)	(0.57)	(0.42)	(0.29)	(0.86)
Energy & Water	-.11258	-.11618	-.09502*	-.09978**	-.07438
	(1.00)	(1.60)	(1.65)	(1.96)	(1.41)
Manufacturing	-.01939	-.03149	-.09357***	-.10525***	-.01183
	(0.67)	(1.54)	(5.91)	(7.50)	(0.88)
Construction	.01331	-.01979	-.02288	.00738	-.01784
	(0.19)	(0.37)	(0.55)	(0.21)	(0.50)
Distribution, Hotels & Rest.	.02577	-.01086	-.04664***	-.06197***	-.00865
	(1.15)	(0.66)	(3.54)	(5.39)	(0.81)
Transport & Communications	.05795	-.03461	-.1202***	-.11516***	-.04306*
	(1.40)	(1.08)	(4.69)	(5.22)	(1.92)
Finance	.1809***	.08308***	-.02583*	-.05751***	.04387***
	(8.71)	(5.07)	(1.89)	(4.94)	(3.74)
Public Admin, Educ. & Health	.12488***	.03525***	-.00931	-.02494***	.00676
	(10.74)	(4.17)	(1.36)	(4.18)	(1.18)
Other Services	.15772***	.05107*	-.0202	-.02469	-.00277
	(4.03)	(1.73)	(0.81)	(1.12)	(0.13)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by industry sector; restricted to women.

insignificant coefficients. Focusing again on the figures for males, wage flexibility in the finance industry is far larger for men than women (and for the sample as a whole). The same is true, to a lesser extent, for the distribution, hotels and restaurants industry, particularly at high levels of centralization.

Occupation

Switching the focus from industry sector to occupational category, table 3.27 gives unemployment elasticities for the sample, disaggregated by occupation. The work of Blanchflower and Oswald (1994) has also examined wage flexibility over occupation, finding that wages are less responsive for those in high skilled occupations. From table 3.27, results appear strong, with all but professional occupations and associate professional and technical occupations returning a significant negative elasticity at four or more levels of unemployment rate disaggregation. Those in professional occupations only experience negative unemployment elasticities at the NUTS 3 and unitary authority levels of disaggregation (in fact, elasticities are positive at the NUTS 1 and NUTS 2 levels), whilst those in associate professional and technical occupations achieve negative and significant elasticities at NUTS 3, UA and TTWA levels, although these are amongst the smallest elasticities. All other occupation groups experience far more flexible earnings, in particular managers and senior officials. This difference is interesting when considering that these two occupational groups have the highest mean earnings, suggesting that the level of mean earnings in an individual's occupational group offers no indication of the level of insulation that earnings may have from regional unemployment. The result of large wage flexibility for managers and senior officials is surprising as it may have been expected that the wages of those with lower skill levels would be more vulnerable to the unemployment rate, with Turunen (1998) finding the largest wage flexibility for sales persons, craftsmen and labourers. Wage flexibility across occupations is fairly uniform, but those in administrative and secretarial occupations seem to have fairly high levels of wage flexibility.

Table 3.27

Wage Flexibility by Occupation (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Managers & Senior Officials	-.03213**	-.06041***	-.09989***	-.11491***	-.0216***
	(2.37)	(5.70)	(10.82)	(14.25)	(2.74)
Professional Occupations	.08106***	.03416***	-.01515*	-.03236***	.00969
	(6.42)	(3.49)	(1.79)	(4.30)	(1.29)
Associate Pro. & Technical	.04221***	-.00396	-.06217***	-.06754***	-.01301*
	(3.61)	(0.44)	(7.96)	(9.78)	(1.89)
Administrative & Secretarial	.0069	-.04796***	-.09378***	-.09831***	-.02241***
	(0.59)	(5.30)	(12.20)	(14.60)	(3.25)
Skilled Trades Occupations	-.06842***	-.06096***	-.06307***	-.07047***	-.03671***
	(4.47)	(5.43)	(6.91)	(8.49)	(4.66)
Personal Service Occupations	-.01785	-.04305***	-.05735***	-.05417***	-.03386***
	(0.97)	(3.15)	(4.96)	(5.28)	(3.36)
Sales & Customer Service	-.07476***	-.05688***	-.07077***	-.07178***	-.05316***
	(3.75)	(3.79)	(5.57)	(6.35)	(4.67)
Process, Plant & Machine	-.04519***	-.0603***	-.06642***	-.06756***	-.03399***
	(2.95)	(5.59)	(7.57)	(8.45)	(4.47)
Elementary Occupations	-.05393***	-.05744***	-.07587***	-.07076***	-.03801***
	(3.80)	(5.47)	(8.64)	(8.84)	(4.89)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by occupation.

Table 3.28 gives the corresponding values from regressions restricted to males. Results for men appear very strong, with all but professional occupations and personal service occupations returning a full set of significant negative elasticities (professional occupations has insignificant unemployment elasticity at NUTS 1 level and there is no significant effect of unemployment on wages at NUTS 2 level for those in personal service occupations). Occupations with the greatest wage flexibility appear to be administrative and secretarial staff, managers and senior officials, and sales and customer service workers. The remaining occupational groups display relatively uniform unemployment elasticities, suggesting that (aside from the aforementioned high elasticity occupations) the choice of industry sector affects an individual's wage flexibility greater than the occupational group they belong to.

Results for females (table 3.29) appear weaker than those for males, with around half of the coefficients statistically insignificant. Again, professional occupations give an interesting result, with significant positive elasticities at four levels of unemployment rate disaggregation. Positive elasticities are also found at differing unemployment rates for several other occupational groups. For females, process, plant and machine operatives experience the most consistent, negative unemployment elasticities, with those in administrative and secretarial occupations, personal service occupations and elementary occupations also displaying significant negative elasticities at several levels of disaggregation, although, in comparison to men, the magnitude of elasticities for women are far smaller. These results suggest that wage flexibility for women is far more dependent on occupational group than for men.

Employment Sector

The final disaggregation relating to an individual's employment is whether their job is part of the public or private sector. Table 3.30 presents unemployment elasticities for the sample as a whole and the corresponding figures when the sample is restricted to only males or females.

Table 3.28

Wage Flexibility by Occupation (Males Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Managers & Senior Officials	-.10134***	-.10134***	-.1125***	-.11412***	-.04164***
	(6.48)	(8.39)	(11.01)	(13.22)	(4.82)
Professional Occupations	-.0121	-.02938**	-.05524***	-.05764***	-.0162*
	(0.78)	(2.43)	(5.46)	(6.72)	(1.86)
Associate Pro. & Technical	-.04782***	-.05864***	-.08361***	-.08191***	-.04057***
	(3.13)	(5.00)	(8.55)	(9.89)	(4.84)
Administrative & Secretarial	-.07671***	-.11281***	-.11955***	-.12291***	-.054***
	(3.33)	(6.45)	(8.28)	(9.90)	(4.17)
Skilled Trades Occupations	-.09149***	-.07439***	-.0641***	-.06703***	-.03644
	(6.42)	(7.10)	(7.69)	(9.11)	(5.16)
Personal Service Occupations	-.06429*	-.04151	-.08054***	-.08042***	-.05587***
	(1.87)	(1.62)	(3.69)	(4.44)	(3.06)
Sales & Customer Service	-.16383***	-.10761***	-.10272***	-.0858***	-.08393***
	(5.46)	(4.74)	(5.42)	(5.31)	(5.01)
Process, Plant & Machine	-.06764***	-.06653***	-.06382***	-.05968***	-.03633***
	(4.56)	(6.31)	(7.53)	(7.94)	(5.10)
Elementary Occupations	-.08483***	-.07309***	-.07767***	-.06615***	-.03802***
	(5.54)	(6.47)	(8.34)	(8.15)	(4.77)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by occupation; restricted to men.

Table 3.29

Wage Flexibility by Occupation (Females Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Managers & Senior Officials	.12123***	.03952**	-.01519	-.04315***	.0216*
	(5.40)	(2.31)	(1.07)	(3.54)	(1.84)
Professional Occupations	.18458***	.0991***	.03573***	.00817	.03483***
	(9.68)	(7.00)	(3.06)	(0.79)	(3.47)
Associate Pro. & Technical	.16948***	.07534***	-.0047	-.01634*	.01622*
	(10.37)	(6.10)	(0.46)	(1.84)	(1.88)
Administrative & Secretarial	.13374***	.03961***	-.0251***	-.03785***	.01849***
	(9.96)	(3.89)	(3.10)	(5.41)	(2.65)
Skilled Trades Occupations	-.00357	.02265	-.02252	-.01752	-.01104
	(0.06)	(0.57)	(0.72)	(0.64)	(0.45)
Personal Service Occupations	.04705**	-.01243	-.03542***	-.02772**	-.01955*
	(2.14)	(0.79)	(2.84)	(2.53)	(1.92)
Sales & Customer Service	.0197	.00114	-.01979	-.02255*	.00121
	(0.77)	(0.06)	(1.36)	(1.78)	(0.10)
Process, Plant & Machine	-.03692	-.04965*	-.03947*	-.04593**	-.05004***
	(0.88)	(1.82)	(1.93)	(2.54)	(2.97)
Elementary Occupations	.00498	-.02163	-.05126***	-.04035***	-.02134*
	(0.19)	(1.15)	(3.52)	(3.03)	(1.72)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by occupation; restricted to women.

Table 3.30

Wage Flexibility by Employment Sector (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample					
Public Sector	.02279**	-.01881***	-.05446***	-.07139***	-.02062***
	(2.46)	(2.70)	(9.25)	(13.63)	(3.97)
Private Sector	-.06863***	-.09036***	-.13246***	-.14155***	-.05278***
	(10.18)	(17.54)	(30.22)	(36.37)	(13.74)
Male					
Public Sector	-.05294***	-.06388***	-.07162***	-.08588***	-.03897***
	(4.07)	(6.55)	(8.94)	(12.49)	(5.68)
Private Sector	-.14928***	-.13391***	-.13867***	-.13571***	-.06624***
	(19.26)	(22.90)	(28.71)	(32.67)	(15.99)
Female					
Public Sector	.124***	.03816***	-.00762	-.02446***	.00348
	(10.01)	(4.25)	(1.05)	(3.87)	(0.57)
Private Sector	.10143***	.02296***	-.05033***	-.06525***	.00549
	(9.03)	(2.72)	(7.34)	(10.95)	(0.96)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by employment sector.

As can be seen from table 3.30, regardless of the level of unemployment rate disaggregation, the earnings of those in private sector employment are far more sensitive to the regional unemployment rate than those in public sector employment. This result has previously been obtained by Card (1995) and Sanz-de-Galdeano (2006). As an aside, the U-shape in wage flexibility observed over the spectrum of centralization can be identified clearly in both the public and private sectors. Turning to the gender specific results, those for men would be considered strongest, as had been expected, displaying elasticities of a larger magnitude than those of the sample as a whole; whilst results for women are found to be highly sensitive to the level of unemployment rate disaggregation. For women in both the public and private sectors, significant and positive elasticities are found at both NUTS 1 and NUTS 2 levels. The only significant negative elasticities for the private sector are found at the NUTS 3 and unitary authority levels of disaggregation, whilst a significant negative result is only found at unitary authority level for the public sector. The remaining results fail to attain the 10% level of significance. The small magnitude of the elasticities found in the public sector (particularly for females) results in several additional positive elasticities when house prices are controlled for, which is most apparent for females, with all public sector elasticities turning positive, except unitary authority, which is insignificant.

Qualifications

I have examined unemployment elasticities disaggregated by factors relating to an individual's employment, but to better understand wage flexibility it is also possible to disaggregate the sample by factors relating to personal characteristics. Table 3.31 disaggregates the sample by the highest level of qualifications an individual possesses, whilst tables 3.32 and 3.33 give the corresponding unemployment elasticities when the sample is restricted to just males or females. Eight levels of qualification are used, ranging from no qualifications held up to doctorate.

Table 3.31

Wage Flexibility by Qualifications (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
PhD	-.00198	-.01412	-.03033	-.04107	.05906*
	(0.04)	(0.36)	(0.89)	(1.35)	(1.90)
Masters	.15487***	.06898***	-.01382	-.04444**	.02037
	(5.64)	(3.19)	(0.70)	(2.56)	(1.12)
PGCE	.17708***	.10657***	.05234**	.0388**	.07087***
	(5.14)	(4.12)	(2.38)	(1.97)	(3.67)
First Degree	.07476***	.02068*	-.05995***	-.08147***	-.01005
	(5.38)	(1.91)	(6.25)	(9.71)	(1.18)
Higher Education	-.11609***	-.11921***	-.12084***	-.12751***	-.06866***
	(7.17)	(9.90)	(12.30)	(14.69)	(8.08)
A Level	-.09527***	-.10361***	-.11708***	-.12643***	-.05481***
	(8.70)	(12.52)	(17.16)	(20.68)	(9.20)
GCSE	-.12622***	-.13065***	-.13727***	-.13881***	-.0534***
	(10.83)	(14.76)	(18.51)	(21.12)	(8.39)
None	-.0542***	-.07019***	-.09785***	-.10896***	-.0425***
	(3.02)	(5.49)	(9.23)	(11.49)	(4.44)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by highest qualification held.

Table 3.32

Wage Flexibility by Qualifications (Males Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
PhD	-.01846	-.04168	-.03928	-.06735**	.01481
	(0.32)	(0.93)	(1.03)	(2.05)	(0.44)
Masters	.08835**	.01314	-.05099**	-.06749***	-.02436
	(2.57)	(0.49)	(2.14)	(3.48)	(1.16)
PGCE	.13052**	.07195*	.05091*	.03388	.06622**
	(2.52)	(1.86)	(1.65)	(1.27)	(2.56)
First Degree	-.0378**	-.06353***	-.09462***	-.10344***	-.04521***
	(2.09)	(4.59)	(7.97)	(10.44)	(4.43)
Higher Education	-.21852***	-.1689***	-.12592***	-.12748***	-.08054***
	(10.48)	(11.10)	(10.20)	(12.10)	(7.65)
A Level	-.16057***	-.13571***	-.12095***	-.1186***	-.05972***
	(13.25)	(14.96)	(16.53)	(18.70)	(9.59)
GCSE	-.20121***	-.1655***	-.15024***	-.14052***	-.06876***
	(13.19)	(14.35)	(15.86)	(17.08)	(8.61)
None	-.10446***	-.09686***	-.11116***	-.10735***	-.05418***
	(4.95)	(6.45)	(9.10)	(10.15)	(5.09)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by highest qualification held; restricted to men.

Table 3.33

Wage Flexibility by Qualifications (Females Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
PhD	.0648	.04778	.00094	.03631	.09423**
	(0.77)	(0.77)	(0.02)	(0.76)	(2.10)
Masters	.23311***	.12332***	.04316	-.00163	.05898**
	(5.69)	(3.99)	(1.60)	(0.07)	(2.55)
PGCE	.17035***	.09835***	.01263	.01807	.01235
	(3.80)	(2.99)	(0.47)	(0.77)	(0.55)
First Degree	.2197***	.12169***	.01375	-.00964	.04497***
	(11.18)	(8.14)	(1.08)	(0.87)	(4.12)
Higher Education	.04785**	-.02289	-.06353***	-.07079***	-.02667**
	(2.07)	(1.40)	(4.93)	(6.27)	(2.44)
A Level	.06268***	-.01006	-.05948***	-.07276***	-.01901**
	(3.25)	(0.71)	(5.36)	(7.45)	(2.05)
GCSE	.04554***	-.0189	-.03856***	-.04739***	.0049
	(2.77)	(1.57)	(4.07)	(5.84)	(0.63)
None	.03511	-.01469	-.02148	-.03689***	.00703
	(1.24)	(0.74)	(1.41)	(2.72)	(0.53)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by highest qualification held; restricted to women.

As seen in previous sets of results, elasticities vary by unemployment rate disaggregation, however, the elasticity of those whose highest qualification is at GCSE level appears to remain high throughout (with the usual decline at TTWA level). The wages of those educated to below degree level appear far more responsive to unemployment than those educated to degree level and above. This result is in line with previous wage curve research (such as Turunen, 1998) which has found that the wages of the less educated are more sensitive to local labour market conditions. This effect appears even clearer when the sample is restricted to men. With women, no education level at first degree level or higher displays a negative unemployment elasticity. These results seem to confirm that the wages of those with lower skill levels are more sensitive to unemployment, after the occupation results clouded the issue. An interesting result can be seen from all three tables, where the wages of those with no qualifications are actually less responsive to unemployment than those educated to GCSE level (and are similar to A level). Using data from the British Social Attitudes Survey between 1985 and 1989, Blanchflower and Oswald (1994) find an insignificant effect of unemployment on the wages of those with the lowest levels of schooling, despite rising to -.0873 for intermediate levels. From my results, degrees seem to act as a divider in the magnitude of wage flexibility, perhaps due to signalling.

Age Group

Elasticities from regressions disaggregated by age are presented in tables 3.34 through 3.36. Age has been split into four divisions. Previous studies (such as Turunen [1998]) have tended to show that younger workers have greater wage flexibility than older workers. My results differ from this result, as those between the ages of 35 and 49 experience the greater wage flexibility, across all unemployment rate levels. Ranking of the remaining age groups in terms of elasticity is inconsistent across degrees of centralization, but it would appear that those over 50 up to retirement age have the least flexible wages. The elasticity of individuals in the age divisions 16 to 24 and 25 to 34 varies according to the level of unemployment rate disaggregation, but generally forms a middle ground between those in the 35 to 49 and 50 to retirement age categories. Whilst my results do not

Table 3.34

Wage Flexibility by Age (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
16 - 24	-.05028***	-.06515***	-.08592***	-.09069***	-.04549***
	(3.36)	(5.78)	(9.04)	(10.71)	(5.35)
25 - 34	.00677	-.027***	-.10934***	-.11398***	-.0357***
	(0.64)	(3.34)	(15.60)	(18.24)	(5.64)
35 - 49	-.06257***	-.09251***	-.12369***	-.13643***	-.04804***
	(6.94)	(13.53)	(21.41)	(26.69)	(9.56)
50 - retirement	-.04776***	-.06844***	-.08653***	-.10993***	-.02929***
	(3.84)	(7.72)	(11.66)	(16.62)	(4.59)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by age group.

Table 3.35

Wage Flexibility by Age (Males Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
16 - 24	-.10263***	-.09556***	-.09637***	-.09747***	-.04985***
	(5.30)	(6.63)	(8.13)	(9.61)	(4.89)
25 - 34	-.07931***	-.0762***	-.11844***	-.11498***	-.05629***
	(6.07)	(7.69)	(14.28)	(16.07)	(7.71)
35 - 49	-.16372***	-.15291***	-.14646***	-.14334***	-.07003***
	(15.18)	(18.87)	(21.86)	(24.96)	(12.34)
50 - retirement	-.11068***	-.10158***	-.09803***	-.11289***	-.04075***
	(7.92)	(9.63)	(11.42)	(15.26)	(5.58)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by age group; restricted to men.

Table 3.36

Wage Flexibility by Age (Females Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
16 - 24	.04552**	-.00308	-.03592***	-.03983***	-.00864
	(2.14)	(0.20)	(2.87)	(3.64)	(0.81)
25 - 34	.13677***	.06492***	-.03242***	-.04376***	.0199**
	(8.71)	(5.46)	(3.27)	(5.06)	(2.34)
35 - 49	.11983***	.02474**	-.03486***	-.05619***	.00339
	(8.52)	(2.39)	(4.18)	(7.80)	(0.49)
50 - retirement	.09091***	.00886	-.02632**	-.04574***	.00453
	(5.04)	(0.67)	(2.52)	(4.96)	(0.52)

Notes: unemployment elasticities reported from specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by age group; restricted to women.

suggest that younger workers have the most sensitive wages, as the previous literature would suggest, there is little difference between the age groups.

Results for males are very similar, although a slight pattern emerges when examining elasticities for the younger age groups: at lower levels of centralization, the elasticity of those in the 16 to 24 age category exceeds those of the 25 to 34 age category, whilst the opposite is true for areas of NUTS 3 or greater decentralization. Turning to the results for females, there are many significant positive and insignificant results, as would be expected; however, all of the significant negative elasticities are found at NUTS 3 and unitary authority levels of disaggregation. Of these, elasticities are highest for younger workers, at NUTS 3 level, but results are similar to results for the sample as a whole at unitary authority level, with those aged 35 to 49 displaying the greatest wage flexibility. Results are highly dependent on unemployment rate aggregation, as those aged 16 to 24 have the most flexible wages at NUTS 3 level, and the least flexible wages at unitary authority level (although all elasticities are similar).

Quantile Regression Results

This section focuses on the results obtained through quantile regression techniques (specifically a decile regression). The reason for extending the methodology to include a series of quantile regressions is to observe how wage flexibility varies over the wage distribution. The previous set of results dealt only with wages at the mean; by extending the methodology to points across the entire wage distribution, it is possible to gain a greater understanding of wage responses to unemployment (similar reasons are behind examining the graduate premium across the earnings distribution in chapter five). As mentioned in the methodology section, I do not expect these results to be uniform across the spectrum of centralization of wage bargaining (as represented by the five levels of unemployment rate aggregation regressions are run at). As in the previous section, results will be presented excluding the house price variable and including the house price variable (necessitating the exclusion of all Scottish observations). Table 3.37 presents quantile regression results for the sample as a whole, with the house price variable excluded, across the five levels of unemployment rate aggregation.

At NUTS 1 level, the highest level of unemployment rate aggregation, representing the most centralized level of wage bargaining, wage flexibility is found to be greatest at the lower end of the wage distribution, gradually decreasing along the wage distribution. This result seems to conform with Buettner and Fitzenberger's (1998) proposition that, as the nationally set contract wage is dominant to the local wage regime in the lower portions of the wage distribution, using the national unemployment rate as an explanatory variable results in the greater wage flexibility (in absolute terms) being observed in the lower tail of the wage distribution. Buettner and Fitzenberger's theory would mean that as the unemployment rate becomes more disaggregated, it is more likely to affect those who engage in wage bargaining at the local level, which will result in the greater effects of the unemployment rate upon wages being seen in the upper section of the wage distribution. From the second row of table 3.37 it can be seen that this effect is starting to become apparent at NUTS 2 level, as whilst those at the lower end of the wage distribution still display the greater wage flexibility, the effect is far less pronounced. Coefficients at all deciles are greater than those found at NUTS 1 level, as would be expected given the U-shaped wage flexibility found using regressions at the mean in the previous section (and can also be seen in the first column of table 3.37). By moving to the NUTS 3 level of unemployment rate aggregation, the effect is amplified, as wage flexibility now rises along the wage distribution, peaking in the upper tail. This effect is even more noticeable at unitary authority level. The switch in wage flexibility from the lower end of the wage distribution to the upper end of the wage distribution can be clearly seen in figure 3.1, where unemployment elasticity has been plotted along the wage distribution for all five levels of unemployment rate aggregation.

Table 3.37

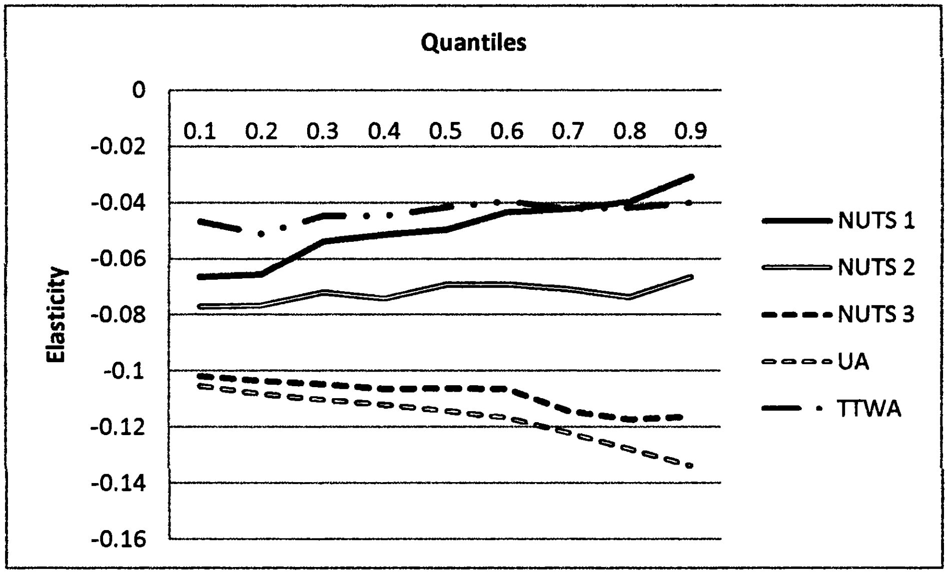
Wage Flexibility from Quantile Regressions (House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
0.1	-.06672***	-.07708***	-.10171***	-.10536***	-.04666***
	(8.59)	(12.87)	(19.53)	(21.64)	(9.52)
0.2	-.0657***	-.07666***	-.10346***	-.10816***	-.05111***
	(11.14)	(16.63)	(25.68)	(30.82)	(13.93)
0.3	-.05376***	-.07195***	-.10468***	-.11018***	-.04466***
	(9.23)	(15.68)	(29.23)	(33.50)	(12.52)
0.4	-.0514***	-.07408***	-.10632***	-.11201***	-.0446***
	(9.19)	(15.37)	(26.98)	(31.86)	(14.17)
0.5	-.04965***	-.06938***	-.10627***	-.11432***	-.04152***
	(8.37)	(14.33)	(28.23)	(32.99)	(12.68)
0.6	-.04339***	-.06897***	-.10641***	-.11669***	-.03948***
	(7.02)	(14.15)	(26.23)	(32.76)	(11.54)
0.7	-.04218***	-.07075***	-.11428***	-.12204***	-.04216***
	(5.80)	(13.71)	(26.03)	(31.91)	(10.63)
0.8	-.03986***	-.07374***	-.11736***	-.12779***	-.04169***
	(4.89)	(12.04)	(25.11)	(28.84)	(8.87)
0.9	-.03073***	-.06661***	-.11634***	-.13374***	-.03996***
	(2.78)	(8.65)	(16.69)	(22.99)	(6.80)

Notes: unemployment elasticities reported quantile regression of specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; deciles shown in first column.

Figure 3.1

Wage Flexibility from Quantile Regressions (House Price Excluded)



The slope of each unemployment rate level shows at which tail of the wage distribution the greater wage flexibility is found: a negatively sloped line results in greater elasticity for the upper portion of the wage distribution, whilst a positively sloped trend line means that wage flexibility is greater at lower levels of the wage distribution. The difference between NUTS 1 and NUTS2, and NUTS 3 and UA can clearly be seen in figure 3.1. Interestingly, at TTWA level, wage flexibility is close to uniform across the wage distribution (with just a small decrease across the wage distribution). Buettner and Fitzenberger find that their most disaggregated level of unemployment rate returns insignificant results at both the mean and all quantiles (Buettner and Fitzenberger test at the 0.1, 0.3, 0.5, 0.7 and 0.9 quantiles). Their German data consists of 259 districts at the local unemployment rate level, whilst at TTWA level I have between 292 and 241 regions.[36] Whilst the TTWA unemployment rate does not return insignificant results, falling coefficients are encountered at both the mean and each decile. The fall in wage flexibility at the mean is predicted by Groth and Johansson's (2004) model. Whilst Buettner and

36 Buettner and Fitzenberger (1998) contend that districts of this size are too small to be considered functional regional labour markets.

Fitzenberger do not consider wage flexibility over the wage distribution at highly disaggregated levels (due to their insignificant district result), Groth and Johansson's model linking the level of centralization in wage bargaining to wage flexibility may offer some insight into the result obtained.

According to Groth and Johansson, at the extremes of centralized and decentralized bargaining, longer contracts are more likely to be observed than at intermediate levels of centralization (resulting in lowered wage flexibility at each end of the centralization spectrum and the U shaped wage flexibility found from regressions dealing with the mean). To extend Groth and Johansson's model to a quantile regression setting and to account for the elasticities found across the wage distribution, at the more centralized and decentralized levels of wage bargaining it would require that at low wages, short contracts are more prevalent than long contracts and that at high wage levels, longer contracts are more likely to be observed than short contracts. Conversely, for intermediate levels of wage setting (and the corresponding aggregation level of unemployment rate) it would be expected that long contracts would be more likely to be observed over short contracts at lower levels of the wage distribution and at higher levels of the wage distribution short contracts would be more likely to be observed opposed to long contracts. This theory requires additional exploration, but adequate information is not available in the APS.

The inclusion of the house price variable has much the same effect as it had upon previous mean regressions (the results of which can be seen in the first column of table 3.38). Once again, significance is greatly affected, with only around half of the coefficients remaining significant. The results are plotted in figure 3.2.

Table 3.38

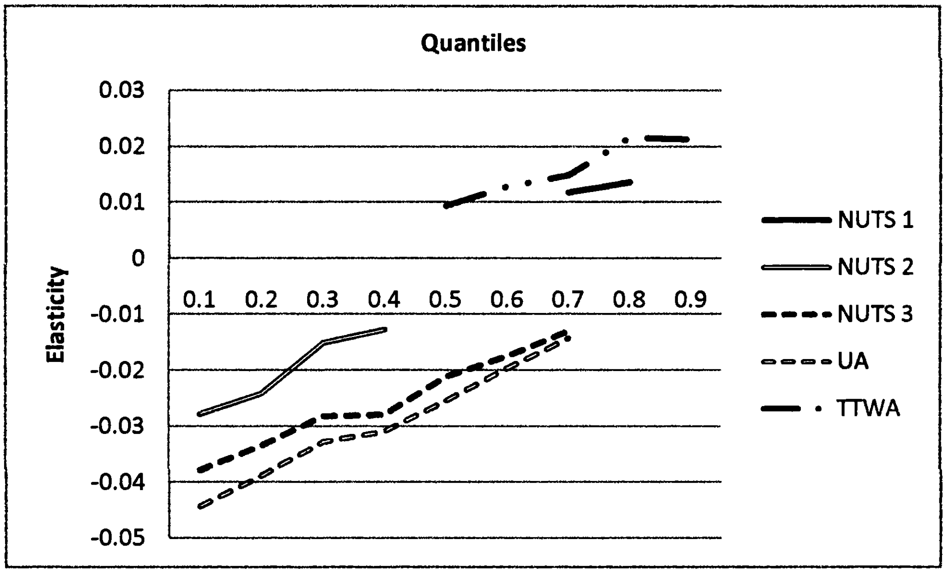
Wage Flexibility from Quantile Regressions (House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
0.1	-.01849**	-.02779***	-.03778***	-.0443***	-.00503
	(2.10)	(3.83)	(6.08)	(7.95)	(0.92)
0.2	-.00819	-.02415***	-.03345***	-.03882***	-.00483
	(1.24)	(4.68)	(7.12)	(8.91)	(1.20)
0.3	-.00095	-.015***	-.02815***	-.03287***	-.0006
	(0.15)	(2.97)	(5.97)	(7.98)	(0.16)
0.4	.00196	-.0127**	-.02783***	-.03089***	.00235
	(0.30)	(2.45)	(5.80)	(7.60)	(0.61)
0.5	.00863	-.00558	-.02108***	-.02547***	.00936**
	(1.38)	(1.09)	(4.49)	(5.90)	(2.43)
0.6	.00635	-.0045	-.01747***	-.01964***	.01282***
	(0.96)	(0.87)	(4.04)	(4.88)	(3.15)
0.7	.01187*	.0015	-.01293***	-.01431***	.01478***
	(1.76)	(0.28)	(2.70)	(3.37)	(3.72)
0.8	.01362*	.00599	-.00551	-.00818	.0215***
	(1.68)	(0.99)	(1.01)	(1.63)	(4.58)
0.9	.003	-.00049	.00564	-.00354	.02132***
	(0.29)	(0.06)	(0.79)	(0.56)	(3.54)

Notes: unemployment elasticities reported quantile regression of specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; deciles shown in first column.

Figure 3.2

Wage Flexibility from Quantile Regressions (House Price Included)



The pattern of the largest wage flexibility being found at the lower portion of the wage distribution is continued along all levels of unemployment rate aggregation, with the magnitude of wage flexibility following the same pattern as the mean (with unemployment elasticity positive at NUTS 1 and TTWA levels). This may imply that the effects seen previously, in table 3.37, may have been caused by some factor that has now been controlled for by the house price variable and Buttner and Fitzenberger's results are being caused by some factor that is now controlled for. After controlling for regional differences in house prices, I am left with results that support the notion that wages are more flexible for those with low earnings, as opposed to those with high earnings, regardless of the level of centralization. This result has previously been found by Sanz-de-Galdeano and Turunen (2006) and Ammermuller *et al.* (2010, for Italy only).

Table 3.39 presents unemployment elasticities obtained via quantile regressions when the sample is restricted to males (house price variable omitted), whilst figure 3.3 is the corresponding graphical representation.

Table 3.39

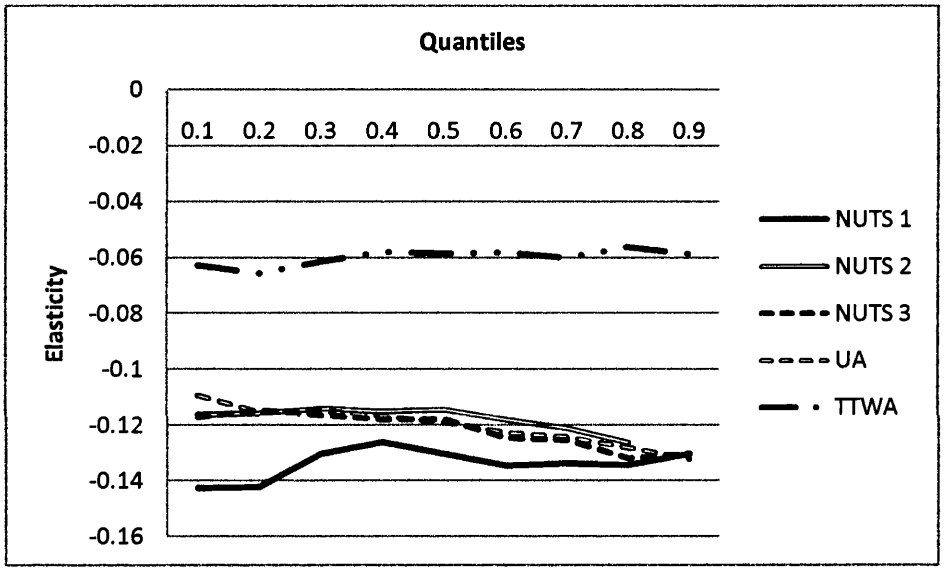
Wage Flexibility from Quantile Regressions (Males Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
0.1	-.14261***	-.11634***	-.11724***	-.10938***	-.06251***
	(15.76)	(15.06)	(20.61)	(21.10)	(10.97)
0.2	-.14222***	-.11587***	-.11474***	-.11535***	-.06546***
	(18.74)	(21.34)	(24.72)	(30.38)	(14.94)
0.3	-.13032***	-.11405***	-.11626***	-.11467***	-.06138***
	(18.59)	(19.91)	(25.91)	(28.84)	(14.92)
0.4	-.12612***	-.11528***	-.11779***	-.11682***	-.05811***
	(18.28)	(21.30)	(27.78)	(31.89)	(14.64)
0.5	-.13039***	-.11442***	-.11786***	-.11896***	-.05847***
	(18.50)	(21.94)	(26.79)	(29.62)	(14.91)
0.6	-.13456***	-.11814***	-.12447***	-.12277***	-.05822***
	(17.12)	(19.88)	(25.46)	(30.37)	(13.43)
0.7	-.13379***	-.12123***	-.12534***	-.12418***	-.06009***
	(16.06)	(18.56)	(25.26)	(29.29)	(14.27)
0.8	-.13441***	-.12635***	-.13181***	-.128***	-.05627***
	(13.30)	(17.14)	(23.93)	(23.78)	(11.56)
0.9	-.13046***	-.12715	-.13023***	-.13198***	-.05862***
	(9.49)	(12.95)	(18.10)	(20.59)	(9.84)

Notes: unemployment elasticities reported quantile regression of specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; deciles shown in first column; restricted to men.

Figure 3.3

Wage Flexibility from Quantile Regressions (Males Only, House Price Excluded)



When the sample is restricted to males, the effects seen for the sample as a whole are still apparent with low earners at high levels of centralization experiencing greater unemployment elasticity than high earners, with the opposite being found when looking at lower levels of centralization. The differences over the wage distribution are greatly reduced, however, and the differences between coefficients are not statistically significant along the earnings distribution. As quantile results tend to center around the result obtained from a regression at the mean, the wage elasticity at TTWA level is smaller than at all other unemployment rates. Figure 3.3 makes it apparent that there is little difference in the results found at the NUTS 2, NUTS 3 and unitary authority levels, although the difference in wage flexibility at both ends of the wage distribution is increasing slightly as the unemployment rate used becomes more disaggregated, as seen in the results for the sample as a whole.

Table 3.40

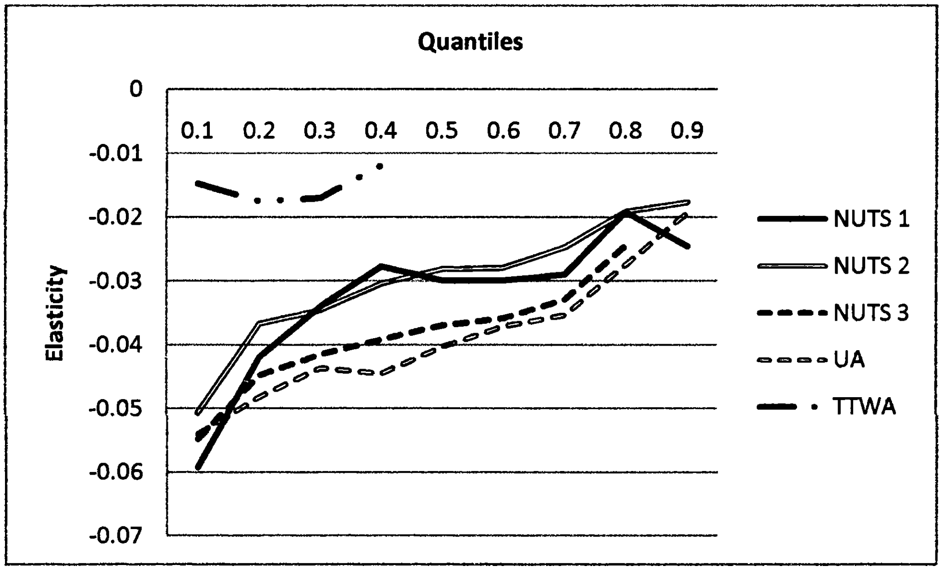
Wage Flexibility from Quantile Regressions (Males Only, House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
0.1	-.05919***	-.05067***	-.05476***	-.05399***	-.01474**
	(5.78)	(6.01)	(7.86)	(8.11)	(2.40)
0.2	-.04202***	-.03675***	-.04478***	-.04818***	-.0175***
	(4.54)	(5.06)	(7.89)	(9.02)	(3.53)
0.3	-.03395***	-.03452***	-.04147***	-.04361***	-.01698***
	(4.36)	(5.75)	(6.85)	(9.43)	(4.04)
0.4	-.02769***	-.03035***	-.03916***	-.0445***	-.01191***
	(3.33)	(4.77)	(6.83)	(9.31)	(2.64)
0.5	-.02988***	-.02814***	-.0369***	-.04029***	-.00718
	(3.58)	(4.57)	(6.38)	(8.22)	(1.62)
0.6	-.02986***	-.0279***	-.03577***	-.0371***	-.00324
	(3.66)	(4.15)	(6.02)	(7.22)	(0.69)
0.7	-.02898***	-.02471***	-.03289***	-.0353***	-.00494
	(3.15)	(3.49)	(5.65)	(7.15)	(1.04)
0.8	-.0191*	-.01909**	-.02435***	-.02742***	.00222
	(1.83)	(2.38)	(3.57)	(4.55)	(0.38)
0.9	-.02443*	-.01766*	-.01197	-.01927**	-.00198
	(1.88)	(1.85)	(1.42)	(2.50)	(0.27)

Notes: unemployment elasticities reported quantile regression of specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; deciles shown in first column; restricted to men.

Figure 3.4

Wage Flexibility from Quantile Regressions (Males Only, House Price Included)



The addition of the house price variable (seen in table 3.40 and figure 3.4) shrinks the magnitude of the coefficients, as would be expected, but significance is maintained by most coefficients. Controlling for regional differences in house prices results in the largest wage flexibility being found for low wage workers, regardless of the level of unemployment rate used, as found for the sample as a whole, again echoing the results found by Sanz-de-Galdeano and Turunen (2006) and Ammermuller *et al.* (2010). The result is logical, as the wages of the less educated are most sensitive to the unemployment rate and they would likely be grouped in the lower end of the wage distribution. As the mean regressions revealed, for males, the lowest wage flexibility is found at TTWA level, followed by NUTS 1 level (although, all unemployment aggregations other than TTWA level produce results of similar magnitude). Table 3.41 and figure 3.5 present quantile regression results for females, with the house price variable omitted.

Table 3.41

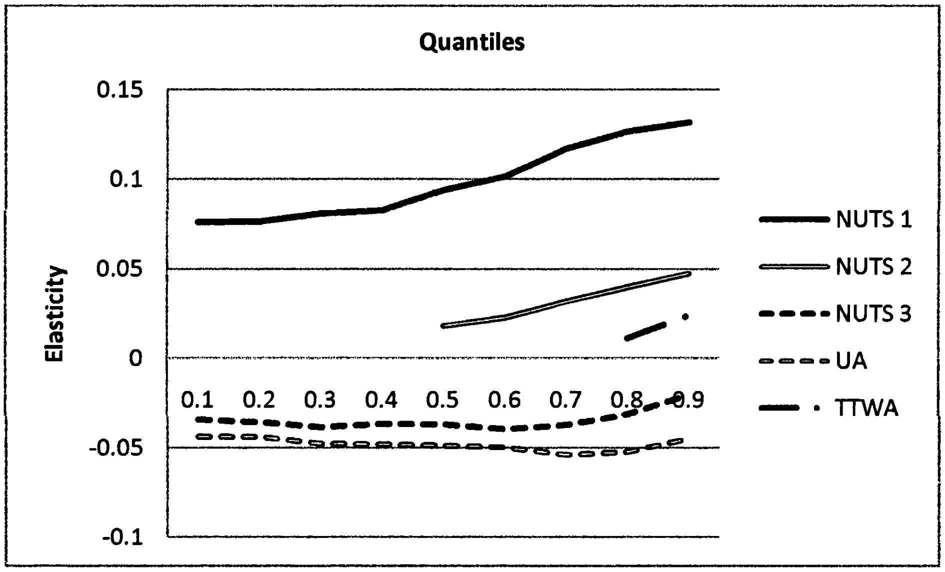
Wage Flexibility from Quantile Regressions (Females Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
0.1	.0763***	-.0013	-.03405***	-.04364***	-.01361**
	(6.31)	(0.15)	(4.68)	(6.77)	(2.29)
0.2	.07649***	.00115	-.0359***	-.04367***	-.00758
	(9.16)	(0.16)	(5.46)	(7.88)	(1.58)
0.3	.08115***	.01197	-.03804***	-.04754***	-.00654
	(9.47)	(1.79)	(7.11)	(9.77)	(1.48)
0.4	.08277***	.00982	-.03662***	-.04787***	-.00318
	(9.36)	(1.47)	(6.71)	(10.62)	(0.72)
0.5	.0942***	.01823***	-.0369***	-.04848***	.00073
	(10.76)	(2.74)	(6.66)	(10.07)	(0.16)
0.6	.10172***	.02278***	-.03959***	-.04953***	.00141
	(10.30)	(3.25)	(7.29)	(10.61)	(0.30)
0.7	.11721***	.03206***	-.03713***	-.05373***	.00477
	(10.74)	(3.85)	(5.96)	(9.70)	(0.86)
0.8	.12648***	.04007***	-.03134***	-.05193***	.01128*
	(10.20)	(4.71)	(4.52)	(8.56)	(1.81)
0.9	.13179***	.04772***	-.02042**	-.0446***	.02429***
	(8.49)	(4.25)	(2.27)	(5.53)	(3.25)

Notes: unemployment elasticities reported quantile regression of specification (1); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; deciles shown in first column; restricted to women.

Figure 3.5

Wage Flexibility from Quantile Regressions (Females Only, House Price Excluded)



Again, results center around the mean estimates, with the largest variation found at the NUTS 1 and NUTS 2 levels of aggregation. There appears to be less variation at other levels of unemployment rate aggregation. It can be seen that elasticities are positive at all deciles for NUTS 1 and NUTS 2 levels and negative at more disaggregated levels (except at TTWA level, for those with the highest earnings). Regarding the pattern in wage flexibility over the wage distribution that has been found for the sample as a whole and the male restriction, the presence of positive elasticities from the female sub-sample cannot be ignored. At the NUTS 1 level of unemployment rate aggregation, the trend line is still upward sloping over the wage distribution. However, due to the positive elasticities, the largest effect on wages due to the local unemployment rate is found for those earning the most, whereas the regression results for males (and the sample as a whole) revealed that the largest absolute wage flexibility was found in the lower portions of the wage distribution.

At the NUTS 2 level of aggregation, coefficients are also positive (but are only significant at the fifth decile and above). Whilst the unemployment elasticity is now positive, the largest wage flexibility is still found for higher earners (as seen for males and the sample as a whole). Both NUTS 3 and unitary authority level results are negative and there is very little difference between low and high earners. Unemployment elasticity at TTWA level transitions from negative to positive as wages increase, although results are only significant at the first, eighth and ninth deciles. The effect of augmenting the specification by adding the house price variable (and therefore excluding all Scottish observations) can be seen in table 3.42 and figure 3.6.

Looking at the NUTS 1 level of aggregation first, controlling for regional differences through the house price variable greatly reduces the disparity in wage flexibility between high and low earners. Elasticity remains positive, and is still greatest for high earners, but the difference has fallen significantly. Results are found to be of a smaller magnitude for the NUTS 2, unitary authority and TTWA levels of aggregation, but the slopes of their trend lines appear identical to the trend line produced for the NUTS 1 unemployment rate, therefore wage flexibility increases with earnings (coefficients at NUTS 2 and TTWA levels are significant from the third and second deciles onwards, although elasticities are positive). Results at the NUTS 3 and unitary authority levels of aggregation were negative when house prices were excluded, but the inclusion of house prices has turned them positive. They are significant from the fifth and seventh deciles and follow the same pattern as the other unemployment rates, with high earners having the largest (positive) unemployment elasticity.

Table 3.42

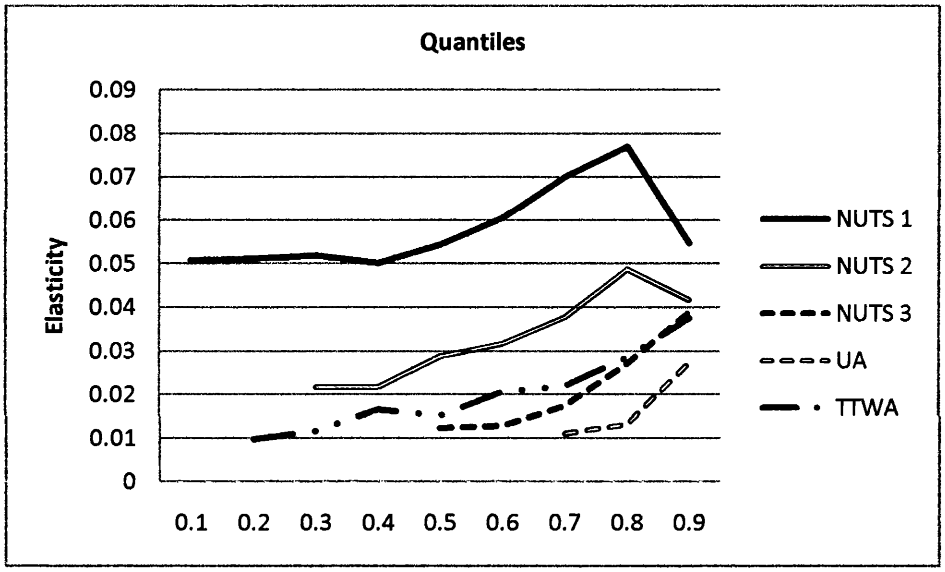
Wage Flexibility from Quantile Regressions (Females Only, House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
0.1	.05069***	.00941	-.00103	-.00817	.00669
	(4.14)	(0.96)	(0.12)	(1.18)	(1.02)
0.2	.05107***	.01089	-.00274	-.00764	.00973*
	(4.96)	(1.34)	(0.42)	(1.34)	(1.92)
0.3	.05185***	.02163***	.00258	-.00201	.01156**
	(5.86)	(3.21)	(0.42)	(0.40)	(2.30)
0.4	.05011***	.02174***	.00451	-.00159	.01662***
	(5.26)	(2.97)	(0.76)	(0.33)	(3.61)
0.5	.05421***	.0288***	.01238**	.0034	.01511***
	(6.01)	(4.14)	(2.12)	(0.71)	(3.12)
0.6	.06046***	.03171***	.01288**	.00634	.02055***
	(6.27)	(4.64)	(2.21)	(1.26)	(4.50)
0.7	.06991***	.03762***	.01735***	.01102*	.02193***
	(6.78)	(4.57)	(2.73)	(1.95)	(4.17)
0.8	.07693***	.04869***	.02714***	.01315**	.02851***
	(5.74)	(5.48)	(3.50)	(1.98)	(4.56)
0.9	.0547***	.04166***	.03886***	.02719***	.03753***
	(3.42)	(3.63)	(4.05)	(3.32)	(4.84)

Notes: unemployment elasticities reported quantile regression of specification (2); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; deciles shown in first column; restricted to women.

Figure 3.6

Wage Flexibility from Quantile Regressions (Females Only, House Price Included)



3.5 Conclusion

In this chapter I have examined wage flexibility over the entire wage distribution, using five different levels of the unemployment rate. By utilizing unemployment rates at five different levels of aggregation, I have observed that the wage response to unemployment varies according to the level that unemployment is measured at, from national to local (which serves as a link to the level of wage bargaining centralization, with the NUTS 1 level representing highly centralized bargaining systems and the TTWA level representing decentralized bargaining). Wage flexibility is found to peak over intermediate levels of unemployment rate aggregation (particularly at the NUTS 3 and unitary authority levels). This result, of U shaped wage flexibility, is in line with results obtained by Groth and Johansson (2004), although their result is obtained using unrelated methodology. It appears that this U-shape in wage flexibility is a result of the composition of male and female effects. Apart from the specific results concerning wage flexibility that arise from using multiple unemployment rate levels, it appears that utilizing several levels of unemployment rate aggregation can provide a greater understanding of wage flexibility than using just one unemployment rate.

I disaggregate by sub-samples and find several results that concur with previous results in the literature, such as the wages of men, private sectors workers and the less educated are more sensitive to the unemployment rate. These results, alongside my results by NUTS 1 regions suggest that the aggregated wage curve consists of many individual wage curves for sub-groups that vary greatly (Turunen, 1998).

The use of differing aggregations of the unemployment rate, whilst illuminating the notion that the use of just one level may be insufficient, do make drawing out policy implications more difficult. Different approaches may be required as we move through the process of economic recovery, depending on the level of wage flexibility in the region or for the worker group. Those with a high level of wage flexibility are likely to have been affected worse by the economic downturn and the sharp rise in unemployment. Therefore it is imperative to ensure that these regions and worker groups are targeted by initiatives to get people back into employment during the period of economic recovery. Policy is more likely to succeed in raising wages through lowering unemployment in these areas as their wages are more likely to respond to any changes in unemployment levels. Regions that show highly elastic wage responses to unemployment include the South East and South West of England, whilst the male, private sector and less educated worker groups also appear to have highly flexible wages.

Turning to the quantile regression results, I found that at highly aggregated levels of the unemployment rate, the greatest flexibility was found in the lower tail of the wage distribution. As the level of unemployment rate becomes more disaggregated, a change in wage flexibility is observed, as wages are found to be more flexible for higher earners. Further increases in disaggregation to TTWA level resulted in a near uniform elasticity across the wage distribution. These effects seemed to dissipate when adding controls for regional house price differences, as wage flexibility was observed to be largest for those at the lower end of the wage distribution (for males and the full sample). Regardless, the differences in wage flexibility over the wage distribution would suggest that regressions at the mean are insufficient to fully capture wage flexibility; points all along the wage distribution should be considered. Those wages of those at the lower tail of the wage distribution are likely to respond most to increases in employment, so the employment prospects of this group should be a priority for policy makers.

Appendix 3.A

Variable Definitions

Earnings	Gross hourly earnings of individual. Entered into model in log form
Unemployment Rate	Proportion of economically active that are classed ILO unemployed. Entered into model in log form, at NUTS 1, NUTS 2, NUTS 3, unitary authority and TTWA level
Population Density	Population per km^2, entered into model in log form, at unitary authority level
House Price	Average house price in each unitary authority divided by national mean house price. Entered into model at unitary authority level
Rural	Dummy variable taking a value of 1, if 50% or more of unitary authority is classified as rural. A value of 1 denotes an urban unitary authority. Based on URIND variable
Male	Dummy variable taking a value of 1 if an individual is male, 0 if female
Age	Age of individual
Age^2	Square of age of individual
Public	Dummy variable taking a value of 1 if an individual is employed in the public sector, o if private sector
Job Tenure	Job tenure of individual

Health Limit	Dummy variable taking a value of 1 if an individual has an activity limiting health problem
Married	Dummy variable taking a value of 1 if an individual is married, 0 otherwise
Plant Size	Vector of dummy variables indicating size of employer. 4 categories: under 25 employees, 25 to 49 employees, 50 to 499 employees, and 500 and over employees
Ethnicity	Vector of dummy variables indicating ethnicity of individual. 6 categories: white, mixed, black, Asian, Chinese, and other.
Industry	Vector of dummy variables indicating industry sector. 9 categories: agriculture and fishing; energy and water; manufacturing; construction; distribution, hotels and restaurants; transport and communications; banking, finance and insurance; public administration, health and education; and other services
Occupation	Vector of dummy variables indicating occupation. 9 categories: managers and senior officials; professional; associate professional and technical; administrative and secretarial; skilled trades; personal services; sales and customer service; process, plant and machinery; and elementary
Qualifications	Vector of dummy variables indicating highest qualification attained. 9 categories: PhD, masters, PGCE, first degree, higher education, A level, GCSE, other, and none
Year	Vector of year dummy variables

Table 3.A1

Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Personal Characteristics				
Hourly Earnings	11.35277	6.651062	1.2	53.13
Male	0.593032	0.49127	0	1
Female	0.406968	0.49127	0	1
Age	39.96636	11.60878	16	64
Age^2	1732.073	937.6447	256	4096
Activity Limiting Health Problem	0.090034	0.286231	0	1
Married	0.305567	0.460649	0	1
Ethnicity				
White	0.940778	0.236041	0	1
Mixed	0.005242	0.072214	0	1
Asian	0.028429	0.166196	0	1
Black	0.01448	0.119458	0	1
Chinese	0.002697	0.051866	0	1
Other	0.008374	0.091126	0	1
Qualifications				
PhD	0.011111	0.104822	0	1
Masters	0.037487	0.189953	0	1
PGCE	0.017662	0.131718	0	1
First Degree	0.153552	0.36052	0	1
Higher Education	0.116825	0.321212	0	1
A Level	0.251311	0.433768	0	1
GCSE	0.215234	0.410986	0	1
Other	0.112462	0.315935	0	1
None	0.087229	0.28217	0	1
Employment				
Job Tenure	8.402216	8.787324	0	49
Public Sector	0.290208	0.45386	0	1
Private Sector	0.709792	0.45386	0	1
Plant Size under 25	0.291032	0.45424	0	1
Plant Size 25 to 49	0.135808	0.342586	0	1
Plant Size 50 to 499	0.372382	0.483441	0	1
Plant Size over 500	0.200778	0.400583	0	1
Industry Sector				
Agriculture & Fishing	0.007424	0.085841	0	1
Energy & Water	0.016253	0.126448	0	1

Manufacturing	0.182308	0.3861	0	1
Construction	0.06761	0.251076	0	1
Distribution, Hotels & Restaurants	0.142813	0.349883	0	1
Transport & Communications	0.078472	0.268913	0	1
Banking, Finance & Insurance	0.152969	0.359959	0	1
Public Admin. Educ. & Health	0.308416	0.461841	0	1
Other Services	0.043577	0.204153	0	1
Occupation				
Managerial	0.17393	0.37905	0	1
Professional	0.145871	0.352978	0	1
Associate Pro. & Technical	0.157587	0.364354	0	1
Administration	0.122509	0.327873	0	1
Skilled Trade	0.104479	0.305881	0	1
Personal Service	0.064282	0.245255	0	1
Sales	0.047206	0.212079	0	1
Process, Plant & Machinery	0.095376	0.293734	0	1
Elementary	0.088762	0.284401	0	1
Year				
2004	0.450631	0.497558	0	1
2005	0.183198	0.38683	0	1
2006	0.183424	0.387015	0	1
2007	0.182747	0.38646	0	1
Geography				
Population Density	1544.689	1926.875	8	13609
Rural Dummy	0.152307	0.359319	0	1

Table 3.A2

Travel to Work Area Exclusions

This table lists the TTWAs that have been excluded from the analysis, due to insufficient observations required to calculate unemployment rates.

Travel To Work Area	Code	Full Sample	Male	Female
Ashford	029		2004	
Thetford	041		2006, 2007	
Mildenhall	043		2007	
Diss	044		2006	2007
Fakenham	045			2004, 2006
Cromer	048			2006
Bury St Edmunds	051			2007
Woodbridge	052			2007
St Austell	058		2006	
Newquay	061	2007	2007	2006, 2007
Penwith and Isles of Scilly	063		2006	
Wadebridge and Bodmin	064			2006
Launceston	065	2005, 2007	2005, 2007	2005, 2006, 2007
Bude	066		2006	2004, 2005, 2007
Camelford	067	2005, 2006, 2007	2005, 2006, 2007	2004, 2005, 2006, 2007
Axminster	072	2006	2005, 2006, 2007	2006
Barnstaple	074	2006	2006	2006
Tiverton	075		2006	2007
Chard	076		2004	2006, 2007
South Molton	079	2004	2004	2004, 2005, 2007
Ilfracombe	080	2006, 2007	2006, 2007	2006, 2007
Kingsbridge	082			2006, 2007
Dartmouth	083	2005, 2007	2005, 2006, 2007	2005, 2007
Newton Abbot	084		2006	
Bideford	086			2007
Holsworthy	087	2006, 2007	2005, 2006, 2007	2004, 2006, 2007
Shaftesbury	090	2007	2007	2007
Bridport	091		2006	2007
Cirencester	094			2006
Evesham	095		2006, 2007	2004
Bridgwater	100			2004
Minehead	101	2007	2007	2007
Devizes	102			2007

Trowbridge and Warminster	104			2006
Leominster	108		2004	2007
Leek	119			2006, 2007
Rugby	122			2004
Boston	133			2006
Skegness and Mablethorpe	134		2007	
Louth	135			2006
Horncastle	136		2005, 2006, 2007	2004
Sleaford	139		2007	
Gainsborough	142	2007	2007	2007
Retford	146			2006, 2007
Settle	151	2005	2005, 2007	2005, 2006
Hawes and Leyburn	156	2005, 2007	2005, 2007	2005, 2006, 2007
Richmond	158	2006	2006	2006
Malton	159			2006
Pickering	160			2004, 2006, 2007
Whitby	161			2006
Lancaster and Morecambe	176		2007	
Keswick	179	2004, 2006, 2007	2004, 2006, 2007	2004, 2005, 2006, 2007
Haltwhistle	183		2004, 2005, 2006	
Appleby	184	2005, 2007	2004, 2005, 2007	2005, 2006, 2007
Penrith	185	2007	2007	2006, 2007
Kendal	186		2005	
Windermere	187	2007	2007	2005, 2007
Barnard Castle	192	2006, 2007	2006, 2007	2006, 2007
Berwick-upon-Tweed	195			2006, 2007
Betws-y-Coed	200		2004, 2005	2006
Ruthin and Bala	201	2005	2005	2005
Welshpool	202			2004, 2006
Llandeilo	209	2005	2004, 2005	2005, 2006, 2007
Fishguard and St David's	211			2006
Portmadoc and Ffestiniog	219			2004, 2006
Machynlleth	220		2006	
Dolgellau and Barmouth	221		2006	
Brecon	226	2006	2005, 2006	2006
Llandrindod Wells	227			2005, 2006
Knighton and Radnor	229	2007	2004, 2006, 2007	2007
Kelso and Jedburgh	233			2007
Kirkcudbright	240		2005, 2007	
Newton Stewart	241			2005
Stranraer	242			2005

Banff	249	2007	2007	2005, 2007
Huntly	252	2004	2004, 2007	2004
Dufftown	255		2007	2004
Badenoch	256		2007	2005, 2006
Thurso	257	2007	2007	2006, 2007
Wick	258	2004, 2005, 2006,	2004, 2005, 2006,	2004, 2005, 2006, 2007
Inverness	259			2007
Lochaber	260	2007	2005, 2007	2004, 2006, 2007
Skye and Ullapool	261	2004, 2006, 2007	2004, 2006, 2007	2004, 2006, 2007
Sutherland	263			2005
Campbeltown	264			2004
Lochgilphead	265		2005	2004
Oban	266	2006	2006	2006, 2007
Girvan	273		2005	
Pitlochry	275	2006, 2007	2005, 2006, 2007	2006, 2007
Crieff	276		2004, 2005	
Orkney Islands	277		2007	2006
Shetland Isles	281			2004
Lewis and Harris	282			2005
Uists and Barra	283			2005, 2006, 2007
Argyll Islands	284			2004, 2005, 2006
Harwich	286		2006	2005
Redruth and Camborne	287			2007
Melton Mowbray and Oakham	290	2006	2006	2006
Matlock	295			2006

Table 3.A3

Wage Flexibility by Aggregated Regions (NUTS 1 Dummies Included, Males Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	-.01911	-.04406***	-.06286***	-.07487***	-.0094**
	(0.82)	(6.22)	(12.49)	(18.39)	(2.33)
London & SE	.1132**	.00349	-.08091***	-.09201***	.00272
	(1.99)	(0.15)	(6.01)	(9.78)	(0.20)
Rest England	-.02382	-.024***	-.06853	-.06531***	-.00126
	(0.51)	(2.75)	(10.03)	(11.09)	(0.25)
Rest UK	-.04254*	-.0522***	-.06095***	-.07003***	-.01047**
	(1.68)	(7.10)	(11.33)	(15.58)	(2.52)
North	-.04952*	-.03846***	-.0446***	-.06115***	-.00922*
	(1.84)	(4.96)	(7.44)	(12.51)	(1.92)
South	.08849*	-.05829***	-.09855***	-.09767***	-.00497
	(1.84)	(3.30)	(10.57)	(13.30)	(0.68)

Notes: unemployment elasticities reported from specification (3); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by region; restricted to men.

Table 3.A4

Wage Flexibility by Aggregated Regions (NUTS 1 Dummies Included, Males Only, House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	.08024**	-.0226***	-.03652***	-.04403***	.0006
	(2.47)	(2.87)	(6.36)	(9.34)	(0.14)
London & SE	.15682***	-.07245***	-.04968***	-.06021***	.00902
	(2.78)	(3.12)	(3.69)	(6.32)	(0.68)
Rest England	-.06102	.0043	-.02836***	-.02756***	.00061
	(1.31)	(0.49)	(4.05)	(4.54)	(0.12)
Rest UK	-.01154	-.00021	-.02496***	-.02925***	.00008
	(0.28)	(0.03)	(3.88)	(5.31)	(0.02)
North	.0001	.0213**	-.00948	-.02018***	.00951*
	(0.00)	(2.32)	(1.25)	(3.23)	(1.67)
South	.13414***	-.10519***	-.06292***	-.06329***	-.00549
	(2.81)	(5.97)	(6.70)	(8.48)	(0.76)

Notes: unemployment elasticities reported from specification (4); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by region; restricted to men.

Table 3.A5

Wage Flexibility by Aggregated Regions (NUTS 1 Dummies Included, Females Only, House Price Excluded)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	.0574**	.00399	-.04085***	-.04649***	-.00432
	(2.38)	(0.50)	(7.39)	(9.98)	(0.95)
London & SE	.1694*	.08351***	-.06461***	-.05128***	.00051
	(1.94)	(3.80)	(4.55)	(4.84)	(0.04)
Rest England	.03708	-.01083	-.03852***	-.04175***	.00771
	(0.88)	(1.05)	(5.11)	(6.66)	(1.35)
Rest UK	.02502	-.01521*	-.03843***	-.04615***	-.0059
	(0.92)	(1.77)	(6.44)	(8.95)	(1.24)
North	.02123	-.02386***	-.04118***	-.05103***	-.02175***
	(0.69)	(2.64)	(6.39)	(9.11)	(4.05)
South	.11385**	.08058***	-.05067***	-.04336***	.02671***
	(2.15)	(4.56)	(4.72)	(5.20)	(3.22)

Notes: unemployment elasticities reported from specification (3); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by region; restricted to women.

Table 3.A6

Wage Flexibility by Aggregated Regions (NUTS 1 Dummies Included, Females Only, House Price Included)

	NUTS 1	NUTS 2	NUTS 3	UA	TTWA
Full Sample	.09094***	.00555	-.01216*	-.0168***	.00844*
	(3.06)	(0.62)	(1.94)	(3.27)	(1.71)
London & SE	.18942**	.00493	-.03215**	-.0228**	.00992
	(2.19)	(0.22)	(2.25)	(2.13)	(0.74)
Rest England	.04735	.01278	-.00378	-.01036	.01283**
	(1.12)	(1.23)	(0.49)	(1.60)	(2.25)
Rest UK	.03433	.01498	-.00223	-.00923	.00809
	(0.87)	(1.49)	(0.31)	(1.55)	(1.54)
North	.02542	.00785	-.00598	-.01209*	-.00341
	(0.56)	(0.72)	(0.75)	(1.80)	(0.55)
South	.13571***	.02001	-.02003*	-.01806**	.02765***
	(2.58)	(1.12)	(1.86)	(2.15)	(3.36)

Notes: unemployment elasticities reported from specification (4); dependent variable is the log of hourly earnings; unemployment rate aggregation level indicated in column headings; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; disaggregated by region; restricted to women.

Chapter 4

Inequalities in Earnings, Employment and Economic Activity: People or Place?

4.1 Introduction

Inequality is widespread across the UK. It can be seen on a large scale, such as the North-South divide, but is also present within much smaller areas. In this chapter I intend to examine the determinants of inequality in terms of earnings, employment and economic activity, focusing on the role of 'people versus place'. Much work has been done in this area regarding earnings inequalities (for example Taylor *et al.*, 2006 and Gibbons *et al.*, 2010), but less attention has been paid to employment and activity inequalities. The value to policymakers of such a study is the determination of whether resources should be directed at areas themselves or the individuals working within them (this could be used in conjunction with the results of earlier chapters which determine to what extent the earnings of places and groups of people will respond to reductions in unemployment). Previous studies, such as Gibbons *et al.* (2010), suggest that individual characteristics account for most of the earnings inequality in the UK and that area effects explain little of the inequality. Results for earnings are tested using a different dataset and expand the methodology to take employment and economic activity into account.

In this chapter, the variance in earnings, employment and activity is decomposed into components that can be explained by area effects and individual characteristics, paying attention to how these effects may be correlated. Using the Annual Population Survey (APS) between 2004 and 2007, the UK is split into 124 labour market areas constructed from existing standalone travel to work areas (TTWAs) and combined TTWAs. I examine the differences in relative importance that area effects and individual characteristics have in explaining earnings, employment and economic activity variation for a number of sub groups and consider how these effects may differ across urban and rural regions. Individual characteristics tend to explain the greatest amount of variation, but I test which components of individual characteristics are of most importance.

In section two a selection of the relevant literature in this field is examined. Section three consists of an investigation of the data and an explanation of the methodology. In section four findings are presented, and in section five conclusions are drawn.

4.2 Literature Review

In this section I will summarize a selection of the relevant literature. Many earlier studies of inequalities were based less on spatial inequalities and more on the inequalities between workers in different industries, amongst other sub groups (Gibbons and Katz, 1992 and Kruegar and Summers, 1988). This literature review is focused on the studies that investigate inequalities over space.

Duranton and Monastiriotis (2002) investigate differences in similar workers' wages across UK regions and the evolution of these differences over the period 1982 to 1997. Their primary data source is the Family Expenditure Survey (FES). Firstly, they use a Mincer earnings function with controls for gender, education, experience and experience squared to obtain coefficients for each year and region (twelve NUTS 1 regions, including Northern Ireland). They then divide their analysis of these coefficients across four strategies: examining the range of the coefficients between 1982 and 1997; calculating the coefficient of variation (the ratio of the standard deviation to the mean) for each variable and examining its evolution; calculating a time series trend for each variable using OLS and checking the correlation between intercepts and trends; and decomposing the changes across regions (London compared with the rest of the UK except the South East and Northern Ireland) between the start and end of the sample period.

Duranton and Monastiriotis note that the mean coefficient of determination (the percentage of variance that can be accounted for from the model) across all regions is 38.6%, with extremes in the East Midlands in 1987 (53.9%) and London in 1996 (20.4%). The coefficient of determination is found to decline over the sample period, suggesting less of the inequality is explained. Examining coefficients between the beginning and end of the period suggests that the coefficients on characteristics converge across regions. They estimate that it would take 22 years for full convergence in real regional fixed effects to take place. Switching to nominal regional fixed effects extends the convergence period to 44 years. Regarding the gender wage gap, they find evidence of convergence over the sample period (with the range between regions falling from 19% to 14%) and estimate the full convergence period at 26 years. Experience and experience squared show strong convergence over 1982 to 1997, and full convergence is calculated at twelve and nine years, whilst education convergence is found to be occurring at a slower rate than the other measures, taking 35 years. They pinpoint the low returns to education in London as the cause for this. The inclusion of a set of dummy variables controlling for occupation has its greatest effect in London, causing a jump in the coefficient of determination. Decomposition analysis reveals that the main determinant of the increase in inequalities is the convergence in the returns to education and experience.

Rice and Venables (2003) investigate regional disparities across Great Britain at the NUTS 3 administrative area level of disaggregation between 1996 and 1998. To do this they use a three step approach. Firstly, they create a model of regional inequalities linking exogenous differences between regions to the equilibrium values of endogenous variables. Secondly, they compare observed outcomes with outcomes from their model. Thirdly, they use the model to identify the sources of regional disparities. Rice and Venables point out that the spatial disparities observed in the UK are greater than those in the EU and the US and that spatial differences in output per worker and differences in regional unemployment rates may be driving this large level of spatial disparity. Differing skill compositions are identified as generating these spatial differences in output per worker, with a positive correlation between skill composition indicators and gross domestic product (GDP) per employee. After controlling for skill composition factors, Rice and Venables state that the spatial differences in skill composition cannot fully explain the degree of spatial disparity in GDP per employee. Rice and Venables consider the role of agglomeration effects on spatial disparity, finding population density to be positively correlated with earnings, house prices, GDP per employee and skill composition (as seen in Ciccone and Hall, 1996, and Ciccone, 2002). Regarding house prices, Rice and Venables find the house price index to show greater spatial disparity than earnings indices and a positive correlation with the earnings indices and GDP per employee. Rice and Venables observe that spatial disparities in household utility may not be correlated with earnings or GDP per employee, possibly explaining the UK's low levels of labour mobility, which they conclude to mean that spatial disparities in earnings and GDP per employee do not necessarily mean there is no disequilibrium in the labour market. Therefore, observed regional disparities may be a part of this equilibrium and must be caused by some underlying regional differences. Rice and Venables' theoretical model shows how small exogenous differences (i.e. geographical advantage/disadvantage) between cities and regions cause the large spatial disparities that can be observed in the UK today and also how, if the exogenous difference has different effects on different industrial sectors, there will be further spatial variation in terms of industrial structure, in turn creating greater spatial variation in skill composition, which will magnify the observed spatial disparity.

Patacchini and Rice (2005) aim to provide a description of the spatial structure of economic performance for Great Britain via exploratory spatial data analysis. To do this they analyse the spatial structure of the productivity component and the occupational component decomposed from regional income per employee (at the NUTS 3 level) over the period 1998 to 2001. As a measure of income they use both gross value added (GVA) per hour worked and average hourly earnings. From their descriptive statistics they find that it is metropolitan areas that have a high ratio of average hourly earnings to GVA per hour worked, with a low ratio in rural areas (including South West Wales). Regarding the North-South divide in Great Britain, this theory is supported by GVA per hour worked data, however, when considering average hourly earnings there is less support, with earnings more dispersed. Patacchini and Rice construct a productivity index and an occupational composition index. The two indices are found to be positively correlated meaning that regions that boast high levels of productivity also have a good occupational composition. Through decomposition methods it is found that 60% of the variance in average hourly earnings is due to variance in the productivity index, whilst the remaining 40% is due to variance in the occupational composition index and the covariance term. Patacchini and Rice's results support positive spatial autocorrelation in income, meaning areas of high income are located in close proximity to other areas of high income. Similarly, areas of low income are found to be in close proximity to other areas of low income.[37] Two specific regimes are identified – a low income regime in the North West and North East regions of the UK and a high income regime of clustering in the South and the East of the UK, supporting the North-South divide theory. In both regimes, atypical areas are identified (by Moran's I statistic, a measure of spatial autocorrelation), but the clustering of similar areas cannot be ignored.[38] Patacchini and Rice suggest that rather than a North-South divide, the results suggest a 'winner's circle' based in the South East of England with earnings high relative to the rest of the UK. The 'winner's circle' is found to have both higher than average productivity and a better than average occupational composition. It is also noted that the low income regime in the North East and North West of Great Britain is driven by poor occupational composition.

Taylor (2006) focuses on regional and industry wage inequalities between UK born men in full time employment over the years 1981 to 1995 (split into three periods: 1981-85, 1986-90 and 1991-95) using the General Household Survey (GHS). He examines and tests several possible explanations for within group wage inequality. Taylor uses a two step approach, firstly splitting inequality into its within group and between group components, using a standard wage equation. The residual from this wage equation is taken as the within group wage inequality after controlling for personal characteristics, occupation, time and region and industry effects. Secondly, aggregate data for ten UK regions and six industries is used to evaluate possible within group wage inequality determinants.

Taylor finds that within group wage inequality has increased in each of the periods under consideration. The services sector tends to have comparatively large levels of

37 The measures of spatial autocorrelation are the Moran's I statistic and Geary's C statistic. Results hold regardless of the measure of income (average hourly earnings or GVA per hour worked).
38 When focusing only on average hourly earnings, the evidence for low income clustering in the North East and North West is reduced.

within group wage inequality in all periods and manufacturing has relatively low levels of wage inequality. Regarding the determinants of industry level within group wage inequality, Taylor finds that the effect of technological change is insignificant and explains less than 2% of wage inequality. Trade intensity (to proxy globalisation) also explains 2% of variation, with de-unionisation explaining 5% of the inequality. Increasing female participation in the labour market is found to account for 12% of variation, whilst immigration accounts for 8%. Taylor finds the largest determinant of within group wage inequality across industries to be changing inter cohort skills, which explains 36% of wage inequalities. When including all six possible determinants at once, 47% of the wage variation is explained. Splitting the industries into manufacturing and non-manufacturing, more of the variation is explained for manufacturing industries (66% to 45%). For manufacturing industries, unionisation is the largest determinant, followed by cohort effects, whilst cohort effects explain the most variation in non-manufacturing industries.

Regarding regional wage inequalities, almost all regions experience an increase in within group wage inequality over the sample period. Wage inequality remains large in the South East at all times. The Midlands regions have the lowest within group wage inequality in 1981, but experience very large increases in wage inequalities over the next half decade. A greater level of the within group wage inequality is explained at a regional level (68%). The largest single determinant of wage inequality is found to be female participation (57%), followed by unionisation (52%), trade intensity (50%), technological change (34%) and cohort effects (28%). The effects of immigration are insignificant in explaining regional within group wage inequalities. Taylor splits regions into North and South, finding that technological change is the major determinant of wage inequalities in the North, whilst in the South female participation explains the largest portion of variation (61%). Taylor also finds this to be a determinant of wage inequality in the North.

Rice *et al.* (2006) examine the causes of spatial inequality in income and productivity. Income data is in the form of gross value added (GVA) from The Office of National Statistics (ONS) and hourly earnings from the New Earnings

Survey (NES). Sub-regional data is entered at NUTS 3 level, although some areas are combined, reducing the number of NUTS 3 areas from 126 to 119. They are able to decompose earnings into a productivity effect and a composition effect, finding that the productivity effect is larger, accounting for around two-thirds of the spatial inequality in earnings. They then use proximity to economic mass to explain the spatial variation. Economic mass is proxied using the population of working age in an area. Proximity is measured in bands based on driving time around each sub-region, with the working age population measured within each proximity band. For both measures of income (GVA and earnings), a significant and positive effect of proximity to economic mass is found, with this effect shrinking with distance, becoming insignificant beyond 80 minutes driving time. This effect is determined to be due to the productivity component, whilst no significant effect is found for the occupational composition component. Rice *et al.* find that doubling the economic mass of an area should increase its productivity by 3.5%.

Combes *et al.* (2007) explain spatial wage disparities in France using a panel dataset between 1976 and 1998. They determine whether these disparities are due to spatial differences in worker skills, non-human endowments or local interactions. Using a two stage approach, they first estimate a wage equation using controls for time varying worker characteristics, worker fixed effects, area fixed effects, industry fixed effects, and the local characteristics of the industry of employment (local interactions). The first stage wage regression reveals that 70% of the variation in individual wages is explained by worker fixed effects, far more than is explained by any other factors. Regarding spatial wage disparities, between 40% and 50% can be explained by differences in skill composition. The second stage of their method involves taking the area fixed effects found during the first stage and regressing them on controls for time, local interactions and local endowments. Interactions are found to play a larger role than endowments, with urbanisation economies (captured by employment density) driving this result. There is support for sorting of worker characteristics, as results suggest that individuals with good unobserved skills sort themselves into labour markets that are large, dense and boast high skill levels. Combes *et al.* conclude that the main determinant of high local wages is this sorting of high skilled workers.

Dickey (2007) examines the increase in earnings inequality in Great Britain between 1976 and 1995 using a quantile regression technique, looking at the differences in earnings at different quantiles. Data comes from the New Earnings Survey (NES). She hypothesises that the increased inequality in earnings is not due to increased inequality between regions, but increased inequality within regions. The inequality between regions may have decreased over this period due to recession narrowing the North-South divide. Dickey states that over the period 1976 to 1995, earnings inequality (measured by 90th - 10th percentile difference) in Great Britain has increased by 25%, with this effect greater for males than females (35.7% to 20.7%). Over this period, the greatest rise in earnings inequality occurred in Wales, where earnings inequality increased by 35.5% (46.9% for males, 32.5% for females). Through the use of kernel density graphs, it is shown that the regional earnings distributions have widened, indicating a substantial rise in inequality at the lower half of the earnings distribution. Dickey reports that earnings inequality between the low skilled and high skilled has grown over the period. As the education level rises, so does earnings inequality, meaning that in regions with progressively increasing education levels, inequality will be greater. Dickey examines the effect age has on earnings inequality. She finds an earnings advantage for workers aged between 36 and 50 years, with workers aged between 16 and 20 years earning the least. The earnings of the 16 to 20 age group, relative to the 36 to 50 year group have diverged for low paid workers, but converged for highly paid workers. Relative to the 36 to 50 year age group, the 21 to 30 year group suffers larger inequality between highly paid workers. Compared to the 36 to 50 year age group, the 61 to 65 year age group's earnings have diverged for lower paid workers, but drawn closer for high paid workers. The gap in wages between males and females increases as earnings increase, with men earning more than women. However, the gender pay gap has decreased over the period. Dickey also reports a North-South divide in gender earnings inequality, as inequality is greater in the North compared to the South. Regarding migration, it is found that (excluding Greater London) high paid workers will benefit more from migration, possibly due to increased mobility and higher skill levels. Dickey concludes by stressing that policy should be targeted toward inequalities within regions, not inequalities between regions, by focusing on investment in education and training.

Data from the New Earnings Survey (NES), the Labour Force Survey (LFS) and the British Household Panel Survey (BHPS) is used by Bell *et al.* (2007) to investigate the public-private sector wage differential in the UK across geographical areas and over time. Three time periods (1975-1979, 1985-1989 and 1993-2001) are chosen as they represent upward stages of the business cycle. They use two approaches to carry out this task. Firstly, they calculate standardized spatial wage differentials (SSWDs) at local authority district level from a Mincer earnings function for the public sector and the private sector. Secondly, they use quantile regression techniques to calculate the public sector premium along the wage distribution (at the 25th, 50th and 75th percentiles). This is carried out at country level due to sample size restrictions.

Bell *et al.* find that private sector inequality between the SSWDs has increased along the three time periods. Whilst the dispersion has increased, the ranking of SSWDs is found to be stable over time and also between genders. Switching to the public sector, they find differences in the pattern of SSWDs compared to the private sector. Bell *et al.* find that private sector SSWDs are more responsive to spatial differences than in the public sector. Regarding the public sector premium, it is found to be greater for women, to have risen over the 1990s after reaching low levels in the 1980s, and to be greater in Wales than Scotland or England. All three datasets are used when obtaining quantile regression results and there are differences between these sets of results. They note that drawing conclusions from these results would be 'based on judgement and an interpretation of the economic findings', however, results seem to suggest that the public sector premium at the 25th and 75th percentiles in Wales and Scotland exceeds that of England. Results from the LFS show a public sector disadvantage at the 75th percentile for England.

Mion and Naticchioni (2008) investigate the spatial distribution of wages in Italy using a matched employer-employee panel (from the Italian Social Security Institute) between 1991 and 1998. A two stage approach is used. First, an augmented Mincer earnings function that includes characteristics including employment density and market potential (the potential demand for goods and services produced in a location) is implemented. They find, initially, that doubling density increases wages by 2.21% and doubling market potential increases wages by 10.88%. Adding individual fixed effects sees the effect of doubling density fall to 0.74% and the market potential coefficient halve to 5%. The inclusion of firm heterogeneity (in the form of firm size) further decreases coefficients to 0.56% and 4.56%. Variance decomposition reveals that the largest determinant of wage inequality is worker skills, followed by time, age and firm size. Employment density and market potential explain little wage variation.

Mion and Naticchioni split the 95 Italian provinces into low density and high density provinces. They find that high density provinces feature far higher skill levels, and that sorting of worker skills accounts for close to 75% of wage inequality between high and low density provinces. Taking advantage of the panel element of the data, they are able to examine the migration of individuals from high density to low density provinces and find that skills migrate towards high density provinces. When splitting provinces by market potential instead of employment density, results are very similar.

A recent study of wage disparities has been carried out by Gibbons *et al.* (2010), where they determine whether wage inequalities are driven by area effects or personal characteristics. Their study uses data from the New Earnings Survey (NES) and the Annual Survey of Hours and Earnings (ASHE) between 1998 and 2008. They assign individuals to travel to work areas (TTWAs) according to where they work. TTWAs with less than 200 average annual observations are combined with other nearby TTWAs with less than 200 average annual observations. Combined TTWAs are classed as rural, whilst stand alone TTWAs are considered urban. Gibbons *et al.* first examine the difference in area average wages when moving between different points on the distribution. When controlling only for the year of observation, the difference between the best and worst area is 61.6%. This falls to 29.4% when a number of controls for personal characteristics are included. The dataset used allows panel analysis, which Gibbons *et al.* make use of by including individual fixed effects. This causes the difference between the best and worst area to fall to 17.4%.

Regression including only TTWA dummies and controls for time explains just less than 6% of wage variance. When individual fixed effects are controlled for, area effects are found to control for less than 1% of total wage variation. Regarding area disparities, area effects account for more of the variance, nearly half with only basic individual characteristic controls included. This falls to 10% for the share of area disparities correlated with personal characteristics and 1% for the uncorrelated share. They find the amount of wage variation explained by personal characteristics to be far higher. Basic controls account for 55-58% of wage variation, whilst this rises to 85-88% when individual fixed effects are included. These effects are found to be relatively stable over the time period. Making use of the panel element of the NES/ASHE dataset, they also look at area effects for movers only. Initially, area effects are found to account for 4% of wage variance, as opposed to 6% for the full sample, but after personal characteristics are controlled for results become very similar.

The differences between urban and rural areas are also considered. Urban areas are confirmed to have higher average wages, with less variation in rural areas. This increased variation is reflected in greater changes between 1998 and 2008 than urban areas in terms of ranking. Over the sample period, the advantage of urban areas has fallen, as the urban premium has dropped from 7.4% to 6.5%. Variance decomposition reveals that area effects explain far more of the wage variation in urban areas (5.71%) than rural areas (2.39%). The larger effect for urban areas remains until individual fixed effects are accounted for; thereafter less than 1% of total variation is explained in both urban and rural areas. This suggests that sorting is greater in urban areas and that sorting on unobservable skills (controlled for by individual fixed effects) is more important for urban areas. Gibbons *et al.* conclude that, relative to individual characteristics, area effects are 'not very important' in explaining wage disparities, and that policies should target individuals not areas.

4.3 Methodology and Data

As the focus of this chapter is upon the variation explained by people and place, I will follow and build upon the methodology used in Gibbons *et al.* (2010), which decomposes earnings variance into portions that can be attributed to individual characteristics (people) and area effects (place). I extend their approach by taking advantage of the wealth of controls available in the APS and by repeating the exercise for employment and economic activity as well as earnings.

If earnings (or employment/activity) inequality can be explained by individual characteristics, it means that the individuals living in an area of high earnings possess characteristics that are lacking in an area of low earnings and that these characteristics are the reason why some areas are prosperous whilst other areas are not. Alternatively, if area effects explain the earnings disparities, it is not the people living in the area, but the area itself that drives prosperity through factors such as local endowments and economic policy. In practice, these two possible causes of inequalities are likely to be correlated (for example, an individual living in a high skilled area may experience productivity gains), an issue explored later in this section.

Data is taken from the Annual Population Survey (APS) between the years 2004 and 2007. The APS is a large scale dataset that combines the Quarterly Labour Force Survey with Local Labour Force Surveys for England, Wales and Scotland, and the Annual Population Survey Boost (although this was discontinued after 2005). The size of the dataset allows me to go down to small levels of disaggregation, which in this chapter allows estimation at the travel to work area (TTWA) level of disaggregation. Following Gibbons *et al.* (2010), the restriction that TTWAs must have a minimum of 200 annual observations to be used is imposed. Of the 232 TTWAs available in the data, 92 of these have 200 or more annual observations and can be included as standalone TTWAs. TTWAs that fall beneath the 200 annual observations threshold are joined with other underrepresented neighbouring TTWAs to form larger areas that are able to pass the 200 annual observations restriction. In some cases it is necessary to join a TTWA with less than 200 annual observations with one that has more than 200 annual observations, due to it being geographically isolated from other TTWAs with under 200 annual observations (for example, Holyhead is joined to Bangor, Caernarfon and Llangefni). Once the process of ensuring all TTWAs have 200 or more annual observations is completed, there are 124 areas left.

Whilst Gibbons *et al.* (2010) define their TTWAs according to place of work, definitions in this chapter are based on place of residence. This is necessitated by carrying out this research for employment and activity as well as earnings. It is unlikely that results will be effected much, due to the way in which TTWAs are constructed, as at least 75% of people who live in that TTWA will also work in that TTWA. Gibbons *et al.* test their results for both TTWA of workplace and TTWA of residence and find there to be little difference, with workplace based area disparities found to be marginally larger.

The remainder of the discussion of methodology and data is split between earnings, employment and activity. An in-depth examination of the data and how earnings vary across sub groups is available in chapter five.

Earnings

Initially, an earnings function with controls for area of residence and time only is estimated. This takes the form:

$$\ln E_i = a + \lambda AREA_r + \alpha YEAR_t + \varepsilon_{irt} \qquad (1)$$

Specification (1) includes controls for the TTWA the individual resides in (AREA) and the year of the observation only (YEAR). No controls for personal characteristics are included. a denotes a constant and ε is the error term. The controls for area of residence are then replaced with controls for personal characteristics only. This gives specification (2):

$$\ln E_i = a + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha YEAR_t + \varepsilon_{irt} \qquad (2)$$

In specification (2) I am able to take advantage of the APS' wide range of personal information and control for an individual's age, gender, marriage status, health, ethnicity, qualifications, job tenure, employer size, employment sector and full time/part time status through a vector of personal characteristics (X). Dummy variables for industry (IND), occupational group of employment (OCC) and the year the observation is taken from (YEAR) are also included. These variables should allow control of most of the observable differences in characteristics between individuals. Specifications (1) and (2) are then combined in specification (3):

$$\ln E_i = a + \lambda AREA_r + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha YEAR_t + \varepsilon_{irt} \qquad (3)$$

Specification (3) includes controls for both the area in which an individual lives and personal characteristics. Whilst spatial disparities on earnings will depend on both the area an individual is employed in and their individual characteristics (specification[3]), each are estimated separately (specifications [1] and [2]) to determine the relative importance of 'people' or 'place' in driving spatial earnings disparities.

From these three specifications I record the coefficient of determination (R^2). The coefficient of determination gives the percentage of variation in earnings explained by the model. Therefore, the percentage of earnings variation explained by the area in which the individual is employed will be the resulting R^2 from specification (1) and the percentage of earnings inequality explained by individual characteristics will be the R^2 recorded from specification (2). Whilst it is important to determine the relative importance of 'people' versus 'place', it is important to make the distinction between correlated and uncorrelated variance. The resulting R^2 from specification (1) will likely pick up area effects that are correlated with individual characteristic effects. If positive sorting is taking place, high skilled workers will locate in high earnings areas, and area effects may be boosted by sorting effects. To find the uncorrelated area variance share I take the difference between the R^2 from specification (3) and the R^2 from specification (2). This will give the earnings variation that is explained by the area effects that are uncorrelated with individual characteristics. The uncorrelated variance share will be lower than the correlated variance share. The uncorrelated individual variance share is obtained by similar methods, taking the difference between R^2 (3) – R^2 (1). This gives the amount of earnings disparity explained by individual characteristics that are uncorrelated with area effects. This methodology for differentiating between correlated and uncorrelated variance shares is taken from Gibbons *et al.* (2010).

When examining sub groups (for example male and female) I will use an additional measure, the people-place ratio (PPR). This is simply the contribution of individual characteristics (people) in explaining earnings variation divided by the contribution of area effects (place). This ratio will tells how the variance share of individual characteristics changes relative to the variance share of area effects when switching between different sub groups, regardless of differences in the total variance.

Table 4.1

Summary Statistics for Earnings by Year

Year	Obs.	Mean	SD	Min	Max	CV
2004	124	9.6087	1.0641	8.0436	13.2328	.1107
2005	124	9.9805	1.1807	8.0453	13.3262	.1183
2006	124	10.4493	1.2183	8.4114	14.1631	.1166
2007	124	10.8188	1.2748	8.5104	14.7748	.1178

Table 4.1 presents earnings summary statistics for the 124 TTWAs in the sample.[39] As expected, the mean level of earnings across the TTWAs has increased year on year, along with the standard deviation, minimum and maximum values. The coefficient of variation (standard deviation divided by mean) has remained relatively stable over the sample period, which shows that wage disparities between TTWAs have also remained relatively stable over the sample period. The results of the previous chapter, which identified areas of high wage flexibility, may suggest that some areas will have been affected to a greater degree by the rises in unemployment resulting from the economic downturn, which could see an increase in earnings inequality. Table 4.A1 in the appendix ranks TTWAs according to mean hourly earnings (aggregated over 2004 to 2007). Hourly earnings are found to vary from £8.40 (Merthyr Tydfil & Aberdare) to £13.64 (Guildford & London), illustrating the size of the earnings gap.

Employment

The analysis is split by the disparities in earnings, employment and economic activity, all of which need to be tackled if the inequality seen across the UK is to be reduced. For employment I use similar methodology to the work on hourly earnings, but replace the log of hourly earnings with an employment dummy. The EMP dummy variable takes a value of 1 if the individual is classified ILO employed and 0 if they are ILO unemployed. The same methodology is used as for earnings equations, but many controls that are available in the earnings equations are not available for employment regressions. Specification (1) remains the same, just with the measure of employment replacing log hourly earnings, giving specification (4).

$$EMP_i = a + \lambda AREA_r + \alpha YEAR_t + \varepsilon_{irt} \qquad (4)$$

[39] General summary statistics are included in the appendix (table 4.A4)

Specifications (2) and (3) are altered, due the changes in the controls available. Specification (2) becomes specification (5):

$$EMP_i = a + \beta X_i + \alpha NS\text{-}SEC_i + \alpha YEAR_t + \varepsilon_{irt} \quad (5)$$

By switching the focus from earnings to employment, the controls for job tenure, employment sector, part time/full time status, industry and size of employer are no longer available. It is still possible to control for occupation using the National Statistics Socio-Economic Classification (NS-SEC), which classifies the whole adult population. As with the previous measure of occupation, this consists of a series of dummy variables. Controls for housing type and dependents are added. Accordingly, specification (3) becomes specification (6):

$$EMP_i = a + \lambda AREA_r + \beta X_i + \alpha NS\text{-}SEC_i + \alpha YEAR_t + \varepsilon_{irt} \quad (6)$$

Specification (6) is as specification (5), but with a vector of dummy variables to indicate the TTWA of residence. Summary statistics for employment between 2004 and 2007 are presented in table 4.2.

Table 4.2

Summary Statistics for Employment by Year

Year	Obs.	Mean	SD	Min	Max	CV
2004	124	.956	.0138	.9064	.9785	.0144
2005	124	.954	.0156	.9117	.9907	.0164
2006	124	.9487	.0191	.8831	.99	.0201
2007	124	.9508	.0167	.9022	.9875	.0174

The mean of employment varies little over the sample period (between .956 and .949). Due to this stability at the mean, the minimum and maximum are also stable, although the minimum value drops slightly in 2006, which is reflected in slight increases in the standard deviation and the coefficient of variation. The rank of mean employment over TTWAs is given in the appendix in table 4.A2. Dorset is found to have the highest mean employment level (.974), whilst Hartlepool sits at the bottom of the table (.912). The large unemployment rate and high mean hourly earnings in London can be demonstrated by comparison of tables 4.A1 and 4.A2, as London ranks 2nd in terms of mean earnings, but is forced down to 117th in table 4.A2 due to its high unemployment rate.

Economic Activity

Finally, I consider economic activity. To do this I replace the employment indicator with an indicator of economic activity (ACT), which takes a value of 1 if an individual is economically active and a value of 0 is an individual is classified economically inactive. This change gives specifications 7 to 9.

$$ACT_i = a + \lambda AREA_r + \alpha YEAR_t + \varepsilon_{irt} \tag{7}$$

$$ACT_i = a + \beta X_i + \alpha NS\text{-}SEC_i + \alpha YEAR_t + \varepsilon_{irt} \tag{8}$$

$$ACT_i = a + \lambda AREA_r + \beta X_i + \alpha NS\text{-}SEC_i + \alpha YEAR_t + \varepsilon_{irt} \tag{9}$$

Apart from the change in the dependant variable from EMP to ACT, the methodology for economic activity is the same as for employment. Table 4.3 gives summary statistics for the 124 TTWAs regarding economic activity. These figures illustrate the importance of economic activity, as close to 24% of the sample would be classified as economically inactive. As with the mean employment rate, the mean activity rate is stable across the four years of the sample, along with the other associated measures. Table 4.A3 in the appendix ranks TTWAs in order of economic activity rate. There are similarities between the rank of TTWAs in terms of activity and the other measures, as Hartlepool is again at the bottom of the ranking, whilst Wiltshire has the highest activity rate.

Table 4.3

Summary Statistics for Economic Activity by Year

Year	Obs.	Mean	SD	Min	Max	CV
2004	124	.7659	.0344	.6682	.8388	.045
2005	124	.7648	.0347	.6863	.8388	.0453
2006	124	.7628	.0395	.6613	.8567	.0518
2007	124	.7628	.0381	.6474	.8375	.0499

4.4 Results

In this section the findings of the variance decomposition are presented. As with the data and methodology section, this section is separated into earnings, employment and economic activity. First, full results from an earnings specification (2) are presented in table 4.4, with results appearing as expected. There is an advantage to men, those who work in the public sector and those who work full time. Returns increase as employer size increases. Ethnicity appears to have little effect on earnings compared to other variables. Qualification returns are strong, with positive returns for all qualifications except GCSE and 'other' (relative to no qualifications). Only the energy and water sector has positive returns relative to the omitted industry of banking, finance and insurance. For occupation, managers and senior officials, professional occupations and associate professional and technical have positive returns relative to administrative and secretarial occupations.

Differences can be seen in the results from employment and activity regressions (table 4.5). Whilst age has a positive effect on economic activity, a negative effect is found for employment. This may reflect the large unemployment rates for younger age groups. The same is true for the coefficients on the male and marriage dummy variables. Positive returns are found for those with a mortgage and those that own their home (for employment) relative to the omitted group of 'other rented'. Qualifications appear as a good determinant of employment and activity. Relative to the omitted group of no qualifications, positive returns are found for all qualifications (except PGCE in the employment regression). Results for ethnicity are stronger than found for the earnings regression. All NS-SEC dummy variables have a large and positive effect compared to the omitted group of never worked, as would be expected.

Table 4.4

Full Results from Earnings Regression

	Coeff.	t stat
Age	.0427***	97.24
Age^2	-.00048***	90.02
Male	.11467***	61.47
Part Time	-.04593***	22.57
Public	.01876***	7.18
Job Tenure	.00729***	69.86
Health Limit	-.05639***	21.80
Married	-.04289***	23.73
Plant Size		
25 to 49	.06652***	27.18
50 to 499	.1024***	52.93
500 and over	.16722***	69.75
Qualifications		
PhD	.30249***	35.42
Masters	.30064***	59.92
PGCE	.21895***	32.33
First Degree	.22034***	67.44
Higher Education	.11691***	35.52
A Level	.05791***	20.90
GCSE	-.00114	0.42
Other	-.01956***	6.22
Ethnicity		
White	.01357	1.62
Mixed	.03676***	2.77
Asian	-.01251	1.32
Black	.02661**	2.54
Chinese	-.0245	1.50
Industry		
Agriculture & Fishing	-.22895***	24.07

Energy & Water	.0275***	3.92
Manufacturing	-.09307***	30.63
Construction	-.02861***	7.05
Distribution, Hotels & Rest.	-.21436***	73.13
Transport & Comms.	-.05539***	14.95
Public Administration	-.1342***	41.96
Other Services	-.18607***	45.26
Occupation		
Managerial	.39456***	127.56
Professional	.40302***	120.02
Associate Pro. & Technical	.22037***	73.59
Skilled Trade	-.02824***	7.56
Personal Service	-.12642***	36.40
Sales	-.10945***	29.74
Process, Plant & Machinery	-.12891***	33.74
Elementary	-.21184***	66.47
Year		
2005	.04263***	20.27
2006	.07323***	34.82
2007	.10529***	49.9
Constant	1.31283***	102.00

Notes: Regression results from specification (2); significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 4.5

Full Results from Employment and Economic Activity Regressions

	Employment		Economic Activity	
	Coeff.	**t stat**	**Coeff.**	**t stat**
Age	-.00303***	18.38	.01692***	76.33
Age^2	.3***	19.18	-.00026***	95.00
Male	-.01706***	28.57	.08094***	92.17
Dependents Under 19	.00346***	11.14	-.03185***	71.98
Health Limit	-.02653***	25.22	-.21401***	168.33
Married	-.01176***	16.54	.01537***	14.81
Housing Type				
Mortgage	.02811***	28.27	.07893***	54.10
Owns Home	.01858***	15.93	-.00163	0.97
Council Home	-.06742***	52.76	-.0454***	26.07
Qualifications				
PhD	.00541*	1.66	.07348***	13.99
Masters	.00506***	2.75	.06971***	23.87
PGCE	.00164	0.63	.07428***	17.87
First Degree	.0031***	2.97	.0568***	35.16
Higher Education	.00728***	6.28	.07699***	43.18
A Level	.01649***	19.21	.05914***	46.93
GCSE	.00109	1.24	.0538***	42.48
Other	-.00486***	4.54	.05568***	35.93
Ethnicity				
White	.02448***	8.35	.04126***	10.47
Mixed	.01085**	2.25	.03859***	5.77
Asian	-.00204	0.62	-.00055	0.12
Black	.00888**	2.38	.05683***	11.10
Chinese	.02237***	3.95	-.02573***	3.38
NS-SEC				
Higher Managerial	.3321***	208.47	.53524***	281.28
Lower Managerial	.32828***	228.74	.53963***	351.29

Intermediate	.31975***	210.84	.53672***	308.75
Small Employers	.33645***	208.69	.56798***	294.96
Lower Supervisory	.33064***	212.48	.526***	289.75
Semi-routine	.31416***	216.41	.51469***	330.67
Routine	.31085***	203.58	.5057***	295.47
Year				
2005	-.00443***	5.81	-.01377***	12.29
2006	-.00952***	11.58	-.01029***	8.56
2007	-.00615***	7.33	-.01189***	9.70
Constant	.64259***	148.21	.17954***	30.55

Notes: Regression results from specifications (5) and (8); significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Earnings

As I presented summary statistics by year of observation, I will also carry out the variance decomposition of earnings by year as well. The results are shown in table 4.6. Columns 1 and 2, which give the amount of earnings variation explained by the component of area effects which is correlated with individual characteristics (column 1) and uncorrelated with individual characteristics (column 2), reveal that very little of the variation in earnings can be explained by the area a person resides in. When allowing area effects to be correlated with individual characteristics it is possible to explain around 4.5% of earnings variation. Partialling out individual characteristics sees the amount of explained variation halved to less than 2%. The coefficient of variation in table 4.1, suggested that earnings variation had varied very little over the period 2004 to 2007. The explanatory power of area effects is similarly stable, varying extremely little over the sample period. Columns 3 and 4 give the correlated and uncorrelated individual characteristics variance share. The amount of earnings variation explained by individual characteristics dwarfs that of area effects, with the uncorrelated individual characteristics variance share being over 25 times the size of the corresponding area effects share. Indeed, individual characteristics are able to explain over half of the variation in earnings (50-54%). As expected, the uncorrelated individual characteristics variance share is smaller than the correlated variance share by around 2-3 percentage points. As results do not seem to vary over time, remaining results are aggregated to include all years. The results of Gibbons *et al.* (2010) support the notion that effects vary little over time (1998 to 2008).

Whilst I have found evidence confirming that individual characteristics are far more useful than area effects in explaining earnings variation, table 4.7 explores which components of individual characteristics account for the most earnings variation, reporting the coefficient of determination for a regression of hourly earnings upon differing sets of characteristics. In the first column I include each set of controls in separate earnings equations (along with year dummies) and report the resultant R^2. This gives the amount of earnings variation that is explained by each specific group of controls. In the second column I start by regressing hourly earnings on just year dummies and then add in each set of controls until all possible controls are included

Table 4.6

Earnings Variance Decomposition by Year

	Area Effects		Individual Characteristics	
	Correlated	**Uncorrelated**	**Correlated**	**Uncorrelated**
2004	.0449	.0185	.5436	.5172
2005	.0455	.0180	.5446	.5171
2006	.0443	.0185	.5386	.5128
2007	.0448	.0185	.5285	.5022

Notes: correlated area effect is calculated as R^2 of specification (1); uncorrelated area effect is calculated as R^2 of specification (3) – R^2 of specification (2); correlated individual characteristic effect is calculated as R^2 of specification (2); uncorrelated individual characteristic effect is calculated as R^2 of specification (3) – R^2 of specification (1); disaggregated by year.

Table 4.7

Earnings Variance Decomposition by Components of Individual Characteristics

	R^2	Cumulative R^2
Year	.0077	.0077
+ Personal Characteristics	.1751	.1751
+ Qualifications	.1985	.3399
+ Employment	.1967	.4029
+ Industry	.1206	.4283
+ Occupation	.4096	.5431
+ Area Effects	.0502	.5605

Notes: column 1 reports R^2 from specification (3) when entering groups of controls individually (along with year dummies); column 2 reports R^2 from specification (3) when groups of controls are entered cumulatively.

together in the final row. The R^2 from each regression is reported, allowing correlation between individual characteristics and area effects. The previous table showed that earnings variation differs little over 2004 to 2007. Accordingly, the set of year dummies controls for less than 1% of earnings variation. Non-employment personal characteristics (including age and its square, gender, ethnicity, health and marital status) are found to explain 18% of earnings variation. Very similar figures are found for qualifications and for employment (full time/part time status, job tenure, employment sector and size of employer). Industry of employment is found to account for less of the earnings variation (12%), which is the least of the individual characteristics groups tested here. Of far more importance to earnings variation is the occupational group a worker belongs to. This is found to explain 41% of the variation in earnings, the majority of explainable variation. This supports the use of occupation as a proxy for skills (such as we have used in chapter two), as it is found to explain more than twice as much earnings variation as highest qualification level. At this point the cumulative R^2 is .5431, which is the most variation that individual characteristics alone will explain. In comparison, area effects (when correlated with individual characteristics) can explain just 5% of earnings variation, bringing the total that individual characteristics along with area effects can account for to 56.05%.

It is likely that the amount of earnings variation that area effects and individual characteristics can explain will vary according to sub-samples. In other chapters, I have shown that unemployment elasticities and the returns to education differ by gender. Table 4.8 splits the sample into male and female and examines the explanatory power of area effects and individual characteristics. Whilst I have previously shown unemployment elasticites to differ by gender, table 4.8 suggests that the determinants of earnings disparities vary little over gender. I have introduced a further measure in the final two columns, the people – place ratio (PPR). This is simply the ratio of the individual characteristics variance share to the area effects variance share, calculated separately depending on whether area effects and individual characteristics are allowed to be correlated or not. A motive for introducing this measure at this point is that different sub groups may have different amounts of earnings variation, but this measure will show how the explanatory power of individual characteristics changes relative to area effects. For men and women none of the measures differ much, the (slightly) larger decline for women than men when switching from correlated to uncorrelated measures suggests that there is greater correlation amongst individual characteristics and area effects for women, although the change is small. The PPR confirms the earlier observation, that the uncorrelated individual characteristics variance share is around 25 times the size of the uncorrelated area effects variance share. The correlated PPR is far smaller at around 10, due to the relatively large reduction in area effects when I ensure it is not correlated with individual characteristics.

Table 4.9 presents results of an earnings variance decomposition by employment sector. Large differences can be seen in columns 1 and 2, where both correlated and uncorrelated area effects in the private sector are double that in the public sector (.0695 to .0302 and .0226 to .0095). That area effects explain a lot more of the earnings variation in the private sector is not surprising due to public sector wage setting being more centralised. More of the earnings variation is explained by individual characteristics in the public sector than the private sector, although both are high (55% in the public sector and 53% in the private sector when individual characteristics are correlated with area effects). Due to the low explanatory power of area effects in the public sector, the PPR for the public sector is more than double that found in the private sector.

It is possible to split the sample by urban/rural status, which will allow the identification of differences in the importance of area effects and individual characteristics for explaining earnings disparities between urban and rural areas. The urban/rural split is defined using three methods. Firstly (method A), I use the URIND variable that is available in the APS to identify TTWAs where more than 50% of the population reports that they live in a rural area. The URIND variable splits areas into four classes: those that have a population of over 10,000 (urban), town and fringe, village, and hamlet. I classify all areas other than urban as rural

Table 4.8

Earnings Variance Decomposition by Gender

	Area Effects		Individual Char.		People - Place Ratio	
	Corr.	**Uncorr.**	**Corr.**	**Uncorr.**	**Corr.**	**Uncorr.**
Male	.0524	.0195	.5295	.4966	10.11	25.47
Female	.0556	.0179	.5332	.4955	9.59	27.68

Notes: correlated area effect is calculated as R^2 of specification (1); uncorrelated area effect is calculated as R^2 of specification (3) – R^2 of specification (2); correlated individual characteristic effect is calculated as R^2 of specification (2); uncorrelated individual characteristic effect is calculated as R^2 of specification (3) – R^2 of specification (1); people-place ratio is the ration of individual characteristic effects to area effects; disaggregated by gender.

Table 4.9

Earnings Variance Decomposition by Employment Sector

	Area Effects		Individual Char.		People - Place Ratio	
	Corr.	**Uncorr.**	**Corr.**	**Uncorr.**	**Corr.**	**Uncorr.**
Public	.0302	.0095	.5485	.5278	18.16	55.56
Private	.0695	.0226	.533	.4861	7.67	21.51

Notes: correlated area effect is calculated as R^2 of specification (1); uncorrelated area effect is calculated as R^2 of specification (3) – R^2 of specification (2); correlated individual characteristic effect is calculated as R^2 of specification (2); uncorrelated individual characteristic effect is calculated as R^2 of specification (3) – R^2 of specification (1); people-place ratio is the ration of individual characteristic effects to area effects; disaggregated by employment sector.

(town and fringe, village, and hamlet). If the 50% threshold is met or exceeded, the TTWA is classified as rural.[40] Method B again makes use of the URIND variable, but recognizes that TTWAs are not going to be entirely urban or entirely rural, but almost all will be a mixture of urban and rural. Here I allow urban/rural status to be defined at postcode level for individuals. As the URIND variable is not available in 2004, this variance decomposition will be restricted to the years 2005-2007.[41] The third method (method C) follows Gibbons *et al.* (2010), where they define standalone TTWAs as urban and combined TTWAs as rural. In some cases it is necessary to join a TTWA with an annual average number of observations under 200 to a TTWA with more than 200 observations. In this case I define the combined TTWA as urban.

Table 4.10 presents the earnings variance decomposition split by rural and urban status. Examining the contribution of area effects in explaining earnings variance first, across all three methods area effects are able to explain more of the variation in urban areas than rural areas. This result is in line with that found by Gibbons *et al.* (2010). There appears to be relatively little difference between rural and urban areas regarding the individual characteristics variance share, which remains between 50 and 55% depending on the rural/urban definition used and whether individual characteristics are allowed to be correlated with area effects. Due to area effects being small for rural areas, the PPR is far greater in rural areas.

It is apparent that individual characteristics are the driving force behind earnings inequalities in the UK and that these are relatively stable over rural and urban areas. However, by carrying out the variance decomposition analysis separately for rural and urban areas, I allow the effects of individual characteristics on log hourly earnings to be different across rural and urban areas, which means that the

[40] Population weights are used, although this makes very little difference and I end up with the same number of rural TTWAs (17) without using population weights.
[41] I do not image that this should effect method A, as rural status is unlikely to change between 2004 and the rest of the sample period.

Table 4.10

Earnings Variance Decomposition by Rural/Urban Status

	Area Effects		Individual Char.		People - Place Ratio	
	Corr.	**Uncorr.**	**Corr.**	**Uncorr.**	**Corr.**	**Uncorr.**
Method A						
Rural	.0366	.0078	.5316	.5028	14.52	64.46
Urban	.0505	.0177	.544	.5112	10.77	28.88
Method B						
Rural	.0459	.0119	.5455	.5115	11.88	42.98
Urban	.0537	.0206	.5364	.5033	9.99	24.43
Method C						
Rural	.0401	.0092	.5327	.5018	13.28	54.54
Urban	.0509	.018	.5443	.5114	10.69	28.41

Notes: correlated area effect is calculated as R^2 of specification (1); uncorrelated area effect is calculated as R^2 of specification (3) – R^2 of specification (2); correlated individual characteristic effect is calculated as R^2 of specification (2); uncorrelated individual characteristic effect is calculated as R^2 of specification (3) – R^2 of specification (1); people-place ratio is the ration of individual characteristic effects to area effects; disaggregated by rural/urban status.

Table 4.11

Earnings Variance Decomposition by Components of Individual Characteristics by Rural/Urban Status

	Rural		Urban	
	R^2	Cum. R^2	R^2	Cum. R^2
Method A				
Year	.0127	.0127	.0072	.0072
+ Personal Characteristics	.1869	.1869	.1748	.1748
+ Qualifications	.1952	.3394	.1989	.3406
+ Employment	.2166	.4070	.1953	.4029
+ Industry	.1325	.4305	.1198	.4283
+ Occupation	.4018	.5316	.4103	.5440
+ Area Effects	.0366	.5394	.0505	.5617
Method B				
Year	.0035	.0035	.0028	.0028
+ Personal Characteristics	.1908	.1908	.1576	.1576
+ Qualifications	.1933	.3412	.1909	.3272
+ Employment	.2013	.4061	.1877	.3915
+ Industry	.1227	.4327	.1136	.4178
+ Occupation	.4153	.5455	.4028	.5364
+ Area Effects	.0459	.5574	.0537	.5570
Method C				
Year	.0107	.0107	.0073	.0073
+ Personal Characteristics	.1912	.1912	.1741	.1741
+ Qualifications	.1873	.3330	.1996	.3409
+ Employment	.2154	.4040	.1953	.4031
+ Industry	.1306	.4305	.1199	.4285
+ Occupation	.4011	.5327	.4105	.5443
+ Area Effects	.0401	.5419	.0509	.5623

Notes: columns 1 and 3 report R^2 from specification (3) when entering groups of controls individually (along with year dummies); columns 2 and 4 report R^2 from specification (3) when groups of controls are entered cumulatively; disaggregated by urban/rural status.

explanatory power of the components of individual characteristics may differ as well. This is explored in table 4.11. Splitting the sample by rural and urban status reveals very little difference between the explanatory powers of the components of individual characteristics. Rural/urban discrepancies are small, but I find that the controls for personal characteristics, employment and industry explain more of the variance for rural areas, whilst the variance share of qualifications and occupation changes as rural/urban definition is changed. Urban TTWAs are able to explain more of their earnings variation than rural TTWAs through area effects.

Employment

Inequalities across the UK in terms of earnings are widespread, but disparities in employment are equally important. I have replaced the log of hourly earnings with an indicator variable for employment status and have amended individual characteristics controls, as some are no longer available (as explained in the methodology section). I first look at the explanatory power of area effects and individual characteristics across the years 2004-2007 in table 4.12. It is clear from the contents of this table that, as found for hourly earnings, the share of variance explained by area effects or individual characteristics varies very little over the sample period. However, the size of the employment variance explained by the variables in the model is far below the amount of earnings variance that can be explained. When allowing area effects to be correlated with individual characteristics it is possible to explain around 0.5% of employment variation, around one tenth of the earnings variation that area effects can explain. Whilst my results and the results of previous studies (Gibbons *et al.*, 2010) show that area effects explain little earnings variation, these results show that area effects are of even less use in explaining employment variation and that almost all of the inequality in employment is due to within TTWA effects rather than between TTWA effects. For employment, individual characteristics explain around a third of the variation they were able to explain in earnings, although some decline would be expected as there are now less controls for individual characteristics (as most employment related controls are not available for the unemployed part of the sample). Little difference is seen between correlated and uncorrelated individual characteristics, suggesting that

Table 4.12

Employment Variance Decomposition by Year

	Area Effects		Individual Characteristics	
	Correlated	**Uncorrelated**	**Correlated**	**Uncorrelated**
2004	.005	.0024	.1735	.1709
2005	.0043	.0024	.1707	.1688
2006	.0055	.0029	.1982	.1956
2007	.0044	.0027	.1797	.178

Notes: correlated area effect is calculated as R^2 of specification (4); uncorrelated area effect is calculated as R^2 of specification (6) – R^2 of specification (5); correlated individual characteristic effect is calculated as R^2 of specification (5); uncorrelated individual characteristic effect is calculated as R^2 of specification (6) – R^2 of specification (4); disaggregated by year.

Table 4.13

Employment Variance Decomposition by Components of Individual Characteristics

	R^2	Cumulative R^2
Year	.0005	.0005
+ Personal Characteristics	.0661	.0661
+ Qualifications	.0048	.0673
+ Occupation	.1516	.1775
+ Area Effects	.0041	.1791

Notes: column 1 reports R^2 from specification (6) when entering groups of controls individually (along with year dummies); column 2 reports R^2 from specification (6) when groups of controls are entered cumulatively.

only a small amount of the individual characteristics that explain employment disparities are correlated with area effects.

Table 4.13 explores the components of individual characteristics, as I try to determine the reason for this large fall in explanatory power. I split individual effects into three groups (non-employment personal characteristics, qualifications and occupation). The personal characteristics component (age and its square, gender, ethnicity, health, marital status, number of dependent children and housing type) has been expanded from the earnings equation, yet it now only explains around 6.6% of the variation in employment compared to 21.3% of earnings variation. Occupation again explains the largest proportion of variation (15.2%), and although this is far less than occupation explains in earnings variation (40.96%), this is the most important determinant of variation, providing a good proxy of the skills of individuals that maybe aren't controlled for just by qualifications. Qualifications perform extremely poorly in explaining the variation in employment, accounting for just 0.5%. This poor result in comparison to occupation is disappointing, suggesting that qualifications alone explain very little of the inequality in employment rates.[42] It is possible that qualifications do little to explain the probability of being employed as opposed to be unemployed, but may be a better measure of whether individuals are active or inactive in the labour market (which is examined in the next sub-section). When all individual characteristic controls and area effects are included in the model it is possible to explain 17.91% of employment variation, around one third of the amount of the variation in hourly earnings that can be explained (56.43%). This would suggest that employment disparities depend far more on unobservable characteristics than earnings disparities.

Splitting the sample by gender reveals that, through the controls available, it is possible to explain more of the variation in employment for men than women (table 4.14). Area effects remain low for both males and females, although they are larger

[42] All qualification dummies, except for GCSE, are significant relative to the omitted group (no qualifications)

for men. There is a large difference between the amount of employment variation explained by individual characteristics for men and women, with the male figure around eight percentage points larger. This would suggest that whilst targeting employment disparities is more difficult than earnings disparities, this is even harder for women. There is very little difference between the correlated individual characteristics variance share and the uncorrelated individual characteristics variance share, but the variance share of area effects halves when the restriction that area effects cannot be correlated with individual effects is imposed. This means that more than half of the area effects that are able to explain employment disparities are correlated with individual effects. The uncorrelated PPR exceeds the correlated PPR, as found for earnings, but the magnitude has increased greatly, with uncorrelated individual characteristics able to explain over a hundred times more of the employment variation than uncorrelated area effects for men. This is due to the tiny uncorrelated area effects.

The first noticeable result of the employment variance decomposition by rural/urban status (table 4.15) is that whilst area effects explain more of the employment variance in urban areas (as found for earnings) when imposing the restriction that TTWAs are either rural or urban, this result is reversed when rural/urban status is based on individual responses and allows each TTWA to be a mix of urban and rural. This result holds whether area effects are allowed to be correlated or uncorrelated with individual effects (although the magnitude is far smaller for uncorrelated variance share, as would be expected). Gibbons *et al.* (2010) find the explanatory power of area effects to be greater in urban areas, which I confirm when using their method (method C) and method A (which like method C, imposes the restriction that TTWAs are either rural or urban). Whilst the gap is smallest between rural and urban using method B for earnings, area effects still explained more of urban variance. Due to the poor explanatory performance of area effects, the PPR is relatively large, except for rural areas using method B (where area effects explain more in rural TTWAs than urban TTWAs). Regarding individual characteristics, the choice of rural/urban definition method has very little effect, with a greater proportion of the employment variance in urban TTWAs being explained by individual characteristics. This result differs from the result found for hourly

Table 4.14

Employment Variance Decomposition by Gender

	Area Effects		Individual Char.		People - Place Ratio	
	Corr.	Uncorr.	Corr.	Uncorr.	Corr.	Uncorr.
Male	.0052	.0021	.2199	.2168	42.29	103.24
Female	.0037	.0015	.1385	.1363	37.43	90.87

Notes: correlated area effect is calculated as R^2 of specification (4); uncorrelated area effect is calculated as R^2 of specification (6) – R^2 of specification (5); correlated individual characteristic effect is calculated as R^2 of specification (5); uncorrelated individual characteristic effect is calculated as R^2 of specification (6) – R^2 of specification (4); people-place ratio is the ration of individual characteristic effects to area effects; disaggregated by gender.

Table 4.15

Employment Variance Decomposition by Rural/Urban Status

	Area Effects		Individual Char.		People - Place Ratio	
	Corr.	Uncorr.	Corr.	Uncorr.	Corr.	Uncorr.
Method A						
Rural	.0024	.0011	.1216	.1203	50.67	109.36
Urban	.0038	.0015	.1812	.1789	47.68	119.27
Method B						
Rural	.0052	.0035	.1231	.1214	23.67	34.69
Urban	.0033	.0016	.1951	.1934	59.12	120.88
Method C						
Rural	.003	.0013	.1219	.1202	40.63	92.46
Urban	.0038	.0016	.1832	.181	48.21	113.13

Notes: correlated area effect is calculated as R^2 of specification (4); uncorrelated area effect is calculated as R^2 of specification (6) – R^2 of specification (5); correlated individual characteristic effect is calculated as R^2 of specification (5); uncorrelated individual characteristic effect is calculated as R^2 of specification (6) – R^2 of specification (4); people-place ratio is the ration of individual characteristic effects to area effects; disaggregated by rural/urban status.

earnings, where there was no difference across rural and urban areas, suggesting that, in terms of observable skills that determine employability (if not earnings) sorting is occurring from rural areas to urban areas.

Results from table 4.15 confirm that the ability of area effects to explain employment variation is minute and that this holds across both rural and urban areas. In table 4.16 I turn my attention to how the components of individual characteristics can account for employment disparities over rural and urban areas. As I regress employment probability on individual characteristics (and area effects) separately for rural and urban TTWAs, I allow the effects of individual characteristics on employment to differ over rural and urban areas, which would allow the explanatory power of the individual characteristic components to differ as well. Table 4.16 reveals that, regardless of rural/urban definition, all components of individual characteristics are able to account for more employment variation in urban areas. The largest difference is in occupation, which is 5 to 6 percentage points higher in urban areas. Qualifications continue to explain less than 1% of employment variation, regardless of rural/urban status.

Economic Activity

Both area effects and individual characteristics have proven to be poor predictors of employment probability. It may be possible that whilst little of the variation in employment can be explained, it may be possible to explain more of the variation in economic activity. As with earnings and employment, I first test if the determinants of economic activity have changed over the sample period. Results show that the controls for area effects, whilst explaining less than 1% of the variation in activity, are slightly more effective than they were in explaining employment disparities (table 4.17). Compared to employment, a far larger proportion of the area effects that explain activity are correlated with individual characteristics, as when switching to the uncorrelated area effect, it drops to less than a quarter of the correlated area effect, and less than the employment area effects variance share. Individual characteristics on the other hand are far more effective at explaining the variation in

Table 4.16

Employment Variance Decomposition by Components of Individual Characteristics by Rural/Urban Status

	Rural		Urban	
	R^2	Cum. R^2	R^2	Cum. R^2
Method A				
Year	.0008	.0008	.0005	.0005
+ Personal Characteristics	.0412	.0412	.0677	.0677
+ Qualifications	.0032	.042	.005	.0689
+ Occupation	.1049	.1216	.1548	.1812
+ Area Effects	.0024	.1227	.0038	.1827
Method B				
Year	.0000	.0000	.0002	.0002
+ Personal Characteristics	.0467	.0467	.0756	.0756
+ Qualifications	.0031	.0478	.0079	.0785
+ Occupation	.1018	.1231	.1665	.1951
+ Area Effects	.0052	.1266	.0033	.1967
Method C				
Year	.0012	.0012	.0004	.0004
+ Personal Characteristics	.0424	.0424	.0684	.0684
+ Qualifications	.0029	.043	.0052	.0698
+ Occupation	.1034	.1219	.1566	.1832
+ Area Effects	.003	.1232	.0038	.1848

Notes: columns 1 and 3 report R^2 from specification (6) when entering groups of controls individually (along with year dummies); columns 2 and 4 report R^2 from specification (6) when groups of controls are entered cumulatively; disaggregated by urban/rural status.

Table 4.17

Economic Activity Variance Decomposition by Year

	Area Effects		Individual Characteristics	
	Correlated	**Uncorrelated**	**Correlated**	**Uncorrelated**
2004	.0087	.0016	.4423	.4352
2005	.0063	.0014	.4354	.4305
2006	.0081	.0018	.4535	.4472
2007	.007	.0012	.4524	.4466

Notes: correlated area effect is calculated as R^2 of specification (7); uncorrelated area effect is calculated as R^2 of specification (9) – R^2 of specification (8); correlated individual characteristic effect is calculated as R^2 of specification (8); uncorrelated individual characteristic effect is calculated as R^2 of specification (9) – R^2 of specification (7); disaggregated by year.

Table 4.18

Economic Activity Variance Decomposition by Components of Individual Characteristics

	R^2	Cumulative R^2
Year	.0005	.0005
+ Personal Characteristics	.2566	.2566
+ Qualifications	.0535	.2711
+ Occupation	.3455	.4435
+ Area Effects	.0073	.4446

Notes: column 1 reports R^2 from specification (9) when entering groups of controls individually (along with year dummies); column 2 reports R^2 from specification (9) when groups of controls are entered cumulatively.

economic activity than employment, explaining around 43-45% of inequality, more than double the amount explained for employment. There is little change in the explanatory powers of area effects or individual characteristics over the sample period.

Whilst I have determined that individual effects are better at explaining economic activity than employment, table 4.18 investigates which components of individual characteristics are driving this result. Once again, occupation is the most effective determinant, explaining 35% of economic activity variance, more than twice that of employment. Personal characteristics explain four times as much activity variance as they did employment variance. Non-employment personal characteristics prove to be a very good determinant of activity, explaining even more than they did for earnings (26% to 21%). Qualifications, which explained only 0.5% of employment activity, are able to explain 5% of economic activity inequalities. Whilst this is an improvement on their explanatory power regarding employment, for activity qualifications still explain only a quarter of the variance they were able to explain for earnings. Driven by the high explanatory power of non-employment personal characteristics and occupation, individual characteristics are able to explain 44% of economic activity disparities.

Whilst I found a large difference in the explanatory power of individual characteristics for employment between men and women, there is little difference for economic activity (table 4.19). Slightly more of the male variation is explained, although the difference is only approximately 2 percentage points. The poor explanatory power of area effects holds for both men and women. Regarding the relative sizes of area effects and individual characteristics, due to the extremely small uncorrelated area effects, the PPR is huge at 316 for men and 283 for women. As I found a difference in employment variation between rural and urban areas, the difference for economic activity is also tested.

Table 4.19

Economic Activity Variance Decomposition by Gender

	Area Effects		Individual Char.		People - Place Ratio	
	Corr.	Uncorr.	Corr.	Uncorr.	Corr.	Uncorr.
Male	.01	.0014	.4518	.4432	45.18	316.57
Female	.0065	.0015	.4291	.4241	66.02	282.73

Notes: correlated area effect is calculated as R^2 of specification (7); uncorrelated area effect is calculated as R^2 of specification (9) – R^2 of specification (8); correlated individual characteristic effect is calculated as R^2 of specification (8); uncorrelated individual characteristic effect is calculated as R^2 of specification (9) – R^2 of specification (7); people-place ratio is the ration of individual characteristic effects to area effects; disaggregated by gender.

Table 4.20

Economic Activity Variance Decomposition by Rural/Urban Status

	Area Effects		Individual Char.		People - Place Ratio	
	Corr.	Uncorr.	Corr.	Uncorr.	Corr.	Uncorr.
Method A						
Rural	.0048	.0012	.408	.4044	85	337
Urban	.0072	.0011	.446	.4399	61.94	399.91
Method B						
Rural	.0072	.0021	.4175	.4124	57.99	196.38
Urban	.0066	.001	.4541	.4485	68.80	448.5
Method C						
Rural	.0048	.0007	.3958	.3917	82.46	559.57
Urban	.007	.001	.4483	.4423	64.04	442.3

Notes: correlated area effect is calculated as R^2 of specification (7); uncorrelated area effect is calculated as R^2 of specification (9) – R^2 of specification (8); correlated individual characteristic effect is calculated as R^2 of specification (8); uncorrelated individual characteristic effect is calculated as R^2 of specification (9) – R^2 of specification (7); people-place ratio is the ration of individual characteristic effects to area effects; disaggregated by rural/urban status.

Table 4.21

Economic Activity Variance Decomposition by Components of Individual Characteristics by Rural/Urban Status

	Rural		Urban	
	R^2	Cum. R^2	R^2	Cum. R^2
Method A				
Year	.0007	.0007	.0004	.0004
+ Personal Characteristics	.2196	.2196	.2592	.2592
+ Qualifications	.0338	.2308	.0558	.2742
+ Occupation	.3111	.408	.3479	.446
+ Area Effects	.0048	.4092	.0072	.4471
Method B				
Year	.0000	.0000	.0000	.0000
+ Personal Characteristics	.2357	.2357	.2741	.2741
+ Qualifications	.0621	.2550	.0788	.2936
+ Occupation	.3152	.4175	.3523	.4541
+ Area Effects	.0072	.4196	.0066	.4551
Method C				
Year	.0008	.0008	.0004	.0004
+ Personal Characteristics	.2061	.2061	.2616	.2616
+ Qualifications	.0268	.2151	.0585	.2772
+ Occupation	.3043	.3958	.3494	.4483
+ Area Effects	.0048	.3965	.007	.4493

Notes: columns 1 and 3 report R^2 from specification (9) when entering groups of controls individually (along with year dummies); columns 2 and 4 report R^2 from specification (9) when groups of controls are entered cumulatively; disaggregated by urban/rural status.

Individual characteristics are found to be better at explaining economic activity inequalities for urban areas, which follows the results found by Gibbons *et al.* (2010) for earnings, although the individual characteristics variance share is large for both rural and urban areas (table 4.20). Results confirm that, regardless of rural/urban status or the method of defining rural/urban status, area effects are relatively ineffective in explaining economic activity disparities.

Table 4.21 examines the contribution of the components of individual characteristics to explaining economic activity inequalities between rural and urban areas. All three of the individual characteristics components explain more urban activity inequality than rural activity inequality. Figures are comparable across all three rural/urban definition methods, except for qualifications, which seem to explain more of the activity variance for method B (with the difference being larger for rural areas).

4.5 Conclusion

In this chapter, I have decomposed the variance in earnings, employment and economic activity into shares attributable to individual characteristics (people) and area effects (place) using the APS between 2004 and 2007. Results indicate that inequalities are driven by individual characteristics as opposed to area effects, a result in line with previous studies such as Gibbons *et al.* (2010). Results imply that only 5% of earnings variance is between area inequality and that within area inequality accounts for 95% of the total disparities. Switching from earnings to employment and economic activity, the amount of between region inequalities fall to less than 1%, meaning that almost all of the employment and activity variation is due to within area inequalities. The policy implication of these results is that, in order to reduce inequality across the UK, policies cannot target areas themselves, but must target the people living in those areas. This is even more important when dealing with employment and activity inequalities, as results suggest that policies aimed at areas themselves would be ineffective. Dickey (2007) states that policy should be directed toward inequalities within regions as opposed to inequalities between regions. It is possible that areas do account for more of the variation in earnings than the model is capturing. For example, place may play a part in the occupational structure, the area which explains the most spatial variation. Therefore, further work in this area will be required. Future work could also examine agglomeration effects, perhaps using a measure of population density.

As area effects are able to explain little of the inequalities in earnings, employment or activity, policies should be aimed at people themselves. I find that individual characteristics are able to account for around 55% of the variation in earnings, 44% of the variation in activity, but only 18% of the variation in employment. This suggests that employment disparities depend more on unobservable characteristics than earnings or activity disparities, and may therefore prove more difficult to target via policy directives.

Earnings, employment and activity variation have been decomposed by the components of individual characteristics, split into non-employment personal characteristics, qualifications, employment, industry and occupation (although the employment and industry components are dropped in the employment and activity analysis). I find that occupation explains the largest amount of variation (41% of earnings inequality, 15% of employment inequality and 35% of activity inequality). Whilst qualifications are able to explain 20% of earnings inequality, around the same amount as non-employment personal characteristics and employment characteristics, qualifications are only able to explain 5% of economic activity inequality and 0.5% of employment inequality. This result is disappointing, as results suggest that policies aimed at raising skills through academic qualifications may do little to reduce employment disparities and to a lesser extent activity disparities (although this should reduce earnings disparities). The occupation controls may be picking up skills and abilities that are not picked up through academic qualifications and better determine earnings and the probability of employment or economic activity. Policy should be directed at developing the skills that can close these gaps.

The variance shares of individual characteristics and area effects according to rural/urban status are also examined. I find that area effects are able to account for more variation in urban areas (except for when allowing rural/urban status to vary by postcode for employment and activity inequality). For earnings, rural/urban status has relatively little effect on the explanatory power of individual effects. For employment, there is a difference in individual characteristics, as individual characteristics can account for around 8 percentage points more of employment variation in urban areas than rural areas, whilst for activity, this difference is around 4 percentage points. This suggests that directing policies to closing employment and activity gaps in rural areas may prove more difficult than in urban areas.

Appendix 4.A

Variable Definitions

Earnings	Gross hourly earnings of individual. Entered into model in log form
Employed	Dummy variable taking a value of 1 if individual is employed, 0 if unemployed
Activity	Dummy variable taking a value of 1 if individual is economically active, 0 if economically inactive
Age	Age of individual
Age^2	Square of age of individual
Part Time	Dummy variable taking a value of 1 if an individual is employed part time, 0 if full time
Public	Dummy variable taking a value of 1 if an individual is employed in the public sector, o if private sector
Job Tenure	Job tenure of individual
Health Limit	Dummy variable taking a value of 1 if an individual has an activity limiting health problem
Married	Dummy variable taking a value of 1 if an individual is married, 0 otherwise
Plant Size	Vector of dummy variables indicating size of employer. 4 categories: under 25 employees, 25 to 49 employees, 50 to 499 employees, and 500 and over employees

Ethnicity	Vector of dummy variables indicating ethnicity of individual. 6 categories: white, mixed, black, Asian, Chinese, and other.
Industry	Vector of dummy variables indicating industry sector. 9 categories: agriculture and fishing; energy and water; manufacturing; construction; distribution, hotels and restaurants; transport and communications; banking, finance and insurance; public administration, health and education; and other services
Occupation	Vector of dummy variables indicating occupation. 9 categories: managers and senior officials; professional; associate professional and technical; administrative and secretarial; skilled trades; personal services; sales and customer service; process, plant and machinery; and elementary
NS-SEC	Vector of dummy variables indication socio-economic group. 8 categories: higher managerial and professional; lower managerial and professional; intermediate occupations; small employers and own account workers; lower supervisory and technical; semi-routine occupations; routine occupations; and never worked and unemployed
Qualifications	Vector of dummy variables indicating highest qualification attained. 9 categories: PhD, masters, PGCE, first degree, higher education, A level, GCSE, other, and none
Housing Type	A vector of dummy variables indicating housing type. 4 categories: has mortgage, owns home, council home, other rented
Dependents	Number of dependent children under the age of 19
Year	Vector of year dummy variables

Table 4.A1

Ranking of TTWAs by Mean Hourly Earnings

Rank	TTWA	Mean Earnings (£)	Relative to National Mean
1	Guildford & Aldershot	13.642	1.344
2	London	13.636	1.343
3	Wycombe & Slough	13.467	1.327
4	Reading & Bracknell	13.352	1.315
5	Newbury	13.004	1.281
6	Luton & Watford	12.940	1.275
7	Crawley	12.657	1.247
8	Tunbridge Wells & Ashford	12.174	1.199
9	Stevenage	12.143	1.196
10	Oxford	12.129	1.195
11	Cambridge	12.087	1.191
12	Southend & Brentwood	11.971	1.179
13	Rugby, Warwick & Stratford upon	11.960	1.178
14	Essex	11.844	1.167
15	Brighton	11.574	1.140
16	Milton Keynes & Aylesbury	11.572	1.140
17	Wiltshire	11.476	1.131
18	Banbury, Cheltenham & Evesham	11.472	1.130
19	Swindon	11.321	1.115
20	Edinburgh	11.248	1.108
21	Cambridgeshire	11.208	1.104
22	Aberdeenshire	11.159	1.099
23	Southampton	11.135	1.097
24	Bath	11.051	1.089
25	Maidstone & North Kent	10.853	1.069
26	Bristol	10.818	1.066
27	Kidderminister, Worcester & Malvern	10.714	1.055
28	South West Sussex	10.638	1.048
29	Gloucester, Monmouth & Cinderford	10.633	1.048
30	York	10.574	1.042

31	Chestershire	10.550	1.039
32	Huddersfield	10.550	1.039
33	Derby & Burton upon Trent	10.548	1.039
34	Wirral & Ellesmere Port	10.521	1.037
35	Portsmouth	10.471	1.032
36	Peterborough	10.461	1.031
37	Glasgow	10.428	1.027
38	Falkirk	10.425	1.027
39	Stirling & Alloa	10.380	1.023
40	Perth & Blairgowrie	10.362	1.021
41	Northampton & Wellingborough	10.346	1.019
42	Ipswich	10.303	1.015
43	North East Yorkshire	10.276	1.012
44	Manchester	10.271	1.012
45	Birmingham	10.259	1.011
46	Nottingham	10.220	1.007
47	Bournemouth	10.216	1.006
48	Leicester	10.200	1.005
49	Calderdale	10.145	0.999
50	South Kent	10.125	0.997
51	East Kent	10.119	0.997
52	Coventry	10.118	0.997
53	Dorset	10.113	0.996
54	Cardiff	10.104	0.995
55	Preston	10.094	0.994
56	Poole	10.023	0.987
57	Leeds	9.955	0.981
58	Exeter & Newton Abbot	9.948	0.980
59	Cumbria	9.932	0.979
60	Lanarkshire	9.884	0.974
61	Dumbarton	9.882	0.974
62	Warrington & Wigan	9.880	0.973
63	Walsall & Cannock	9.858	0.971
64	Berwick, Galashiels & Peebles	9.835	0.969
65	Mid Wales Border	9.812	0.967

66	East Norfolk	9.778	0.963
67	Newcastle & Durham	9.741	0.960
68	Derbyshire	9.733	0.959
69	North Scotland	9.712	0.957
70	Darlington	9.707	0.956
71	Greenock	9.702	0.956
72	Morpeth, Ashington & Alnwick	9.689	0.954
73	Sheffield & Rotherham	9.669	0.953
74	Bolton	9.647	0.950
75	Angus	9.633	0.949
76	Fife	9.626	0.948
77	Bridgend	9.603	0.946
78	West Norfolk	9.600	0.946
79	Dudley & Sandwell	9.573	0.943
80	Scottish Border	9.568	0.943
81	Liverpool	9.559	0.942
82	Newport & Cwmbran	9.518	0.938
83	Moray	9.517	0.938
84	Rochdale & Oldham	9.464	0.932
85	Livingston & Bathgate	9.457	0.932
86	Rhyl & Denbigh	9.442	0.930
87	Irvine & Annan	9.421	0.928
88	North Lancashire	9.419	0.928
89	Blackburn	9.415	0.928
90	Staffordshire	9.403	0.926
91	Blackpool	9.388	0.925
92	Ayr & Kilmarnock	9.384	0.925
93	Somerset & East Devon	9.373	0.923
94	Anglesey & Bangor	9.360	0.922
95	Telford & Bridgnorth	9.360	0.922
96	Plymouth	9.351	0.921
97	Hull	9.347	0.921
98	Wakefield & Castleford	9.346	0.921
99	Middlesborough & Stockton	9.292	0.915
100	Gwynedd & Conwy	9.224	0.909

101	Wrexham & Whitchurch	9.219	0.908
102	Swansea Bay	9.211	0.907
103	Bradford	9.195	0.906
104	Hereford & Leominster	9.173	0.904
105	Lincolnshire	9.140	0.900
106	Carmarthenshire & Brecon	9.121	0.899
107	Wolverhampton	9.120	0.898
108	Cornwall	9.113	0.898
109	North Devon	9.102	0.897
110	Doncaster	9.066	0.893
111	Hartlepool	9.031	0.890
112	West Mid Wales	9.028	0.889
113	Sunderland	8.992	0.886
114	South Devon	8.990	0.886
115	Isle of Wight	8.971	0.884
116	Barnsley	8.958	0.882
117	Ebbw Vale & Abergavenny	8.873	0.874
118	South West Scotland	8.765	0.864
119	Grimsby	8.701	0.857
120	Scunthorpe	8.641	0.851
121	Argyll & Perthshire	8.632	0.850
122	Pembrokeshire	8.628	0.850
123	Mansfield	8.524	0.840
124	Merthyr Tydfil & Aberdare	8.396	0.827

Table 4.A2

Ranking of TTWAs by Mean Employment

Rank	TTWA	Mean Employment	Relative to National Mean
1	Dorset	0.973935	1.021816
2	Chestershire	0.973174	1.021018
3	Wiltshire	0.973019	1.020855
4	Poole	0.972189	1.019984
5	Scottish Border	0.971981	1.019766
6	Banbury, Cheltenham & Evesham	0.97197	1.019755
7	Rugby, Warwick & Stratford upon	0.971676	1.019446
8	Hereford & Leominster	0.971653	1.019422
9	North East Yorkshire	0.970306	1.018009
10	Bath	0.970192	1.017889
11	Perth & Blairgowrie	0.969551	1.017217
12	Newbury	0.96867	1.016293
13	Rhyl & Denbigh	0.967769	1.015347
14	Wrexham & Whitchurch	0.967628	1.0152
15	Moray	0.967615	1.015186
16	Oxford	0.967312	1.014868
17	Gloucester, Monmouth & Cinderford	0.967079	1.014623
18	South Devon	0.966697	1.014222
19	Bournemouth	0.96667	1.014194
20	Ipswich	0.966075	1.01357
21	Exeter & Newton Abbot	0.965997	1.013488
22	North Scotland	0.965663	1.013138
23	Cambridge	0.965354	1.012813
24	Darlington	0.965127	1.012575
25	Guildford & Aldershot	0.964896	1.012332
26	Northampton & Wellingborough	0.96479	1.012222
27	Bristol	0.964574	1.011995
28	Carmarthenshire & Brecon	0.964131	1.011531
29	Reading & Bracknell	0.964075	1.011471
30	Tunbridge Wells & Ashford	0.963898	1.011286

31	Argyll & Perthshire	0.963654	1.011029
32	Swindon	0.963521	1.010891
33	Southampton	0.963203	1.010556
34	Peterborough	0.963139	1.010489
35	Mid Wales Border	0.963102	1.01045
36	Somerset & East Devon	0.962898	1.010237
37	York	0.962106	1.009405
38	Kidderminister, Worcester & Malvern	0.961826	1.009112
39	South West Sussex	0.961357	1.00862
40	Portsmouth	0.961141	1.008393
41	Berwick, Galashiels & Peebles	0.9611	1.00835
42	Isle of Wight	0.961015	1.008261
43	Crawley	0.96052	1.007742
44	South West Scotland	0.960412	1.007629
45	Milton Keynes & Aylesbury	0.959951	1.007145
46	West Norfolk	0.959725	1.006907
47	Southend & Brentwood	0.959653	1.006832
48	Staffordshire	0.959026	1.006174
49	Scunthorpe	0.958964	1.006109
50	Cambridgeshire	0.958697	1.005829
51	Wycombe & Slough	0.958612	1.00574
52	Calderdale	0.957857	1.004948
53	North Devon	0.957593	1.004671
54	Essex	0.957588	1.004666
55	West Mid Wales	0.957533	1.004608
56	Wakefield & Castleford	0.957326	1.00439
57	Luton & Watford	0.956595	1.003624
58	Preston	0.95636	1.003377
59	Cumbria	0.956336	1.003352
60	Anglesey & Bangor	0.956115	1.00312
61	Aberdeenshire	0.955585	1.002564
62	Blackpool	0.955382	1.002351
63	Plymouth	0.955253	1.002216
64	East Norfolk	0.955181	1.00214
65	Livingston & Bathgate	0.95461	1.001541

66	Gwynedd & Conwy	0.954288	1.001203
67	Derby & Burton upon Trent	0.954024	1.000927
68	Blackburn	0.953604	1.000486
69	Warrington & Wigan	0.953153	1.000013
70	Falkirk	0.952966	0.999816
71	Derbyshire	0.952476	0.999302
72	Telford & Bridgnorth	0.951105	0.997864
73	Leicester	0.950441	0.997167
74	Wirral & Ellesmere Port	0.95012	0.996831
75	Hull	0.949874	0.996573
76	Cornwall	0.949844	0.99654
77	Huddersfield	0.949287	0.995956
78	Edinburgh	0.94893	0.995582
79	Lincolnshire	0.948923	0.995574
80	Leeds	0.947833	0.994431
81	South Kent	0.947605	0.994192
82	Coventry	0.946883	0.993434
83	Rochdale & Oldham	0.946811	0.993358
84	Barnsley	0.946803	0.993351
85	East Kent	0.946502	0.993034
86	Maidstone & North Kent	0.945954	0.99246
87	North Lancashire	0.945611	0.9921
88	Manchester	0.945367	0.991844
89	Stevenage	0.945026	0.991486
90	Newport & Cwmbran	0.944574	0.991012
91	Cardiff	0.944491	0.990925
92	Brighton	0.944374	0.990801
93	Bolton	0.944168	0.990585
94	Pembrokeshire	0.943877	0.99028
95	Nottingham	0.943802	0.990202
96	Lanarkshire	0.94374	0.990137
97	Walsall & Cannock	0.943547	0.989935
98	Doncaster	0.941772	0.988072
99	Mansfield	0.941389	0.98767
100	Dumbarton	0.941283	0.987559

101	Swansea Bay	0.94128	0.987555
102	Grimsby	0.941208	0.98748
103	Bridgend	0.940928	0.987187
104	Sunderland	0.940465	0.986701
105	Sheffield & Rotherham	0.940047	0.986262
106	Wolverhampton	0.939689	0.985887
107	Morpeth, Ashington & Alnwick	0.938802	0.984956
108	Glasgow	0.938242	0.984369
109	Stirling & Alloa	0.93793	0.984042
110	Dudley & Sandwell	0.937437	0.983524
111	Fife	0.937289	0.983368
112	Middlesborough & Stockton	0.936805	0.98286
113	Angus	0.936509	0.982551
114	Bradford	0.936245	0.982273
115	Newcastle & Durham	0.935278	0.981259
116	Ebbw Vale & Abergavenny	0.933896	0.979808
117	London	0.932213	0.978043
118	Ayr & Kilmarnock	0.931456	0.977249
119	Liverpool	0.928992	0.974664
120	Merthyr Tydfil & Aberdare	0.927936	0.973556
121	Birmingham	0.927037	0.972613
122	Irvine & Annan	0.923057	0.968437
123	Greenock	0.917958	0.963087
124	Hartlepool	0.911707	0.956529

Table 4.A3

Ranking of TTWAs by Mean Activity

Rank	TTWA	Mean Activity	Relative to National Mean
1	Wiltshire	0.831923	1.08831
2	North Scotland	0.83131	1.087509
3	Guildford & Aldershot	0.828832	1.084267
4	Banbury, Cheltenham & Evesham	0.819934	1.072626
5	Swindon	0.817831	1.069875
6	Aberdeenshire	0.81707	1.06888
7	Cambridgeshire	0.81615	1.067677
8	Newbury	0.815359	1.066641
9	Milton Keynes & Aylesbury	0.815101	1.066304
10	Northampton & Wellingborough	0.812277	1.06261
11	Reading & Bracknell	0.808952	1.05826
12	Crawley	0.808487	1.057652
13	Wycombe & Slough	0.80625	1.054725
14	Oxford	0.805512	1.05376
15	Argyll & Perthshire	0.805503	1.053748
16	Stevenage	0.805017	1.053112
17	Hereford & Leominster	0.803471	1.05109
18	Cambridge	0.801852	1.048972
19	Southampton	0.799801	1.046288
20	Tunbridge Wells & Ashford	0.797408	1.043158
21	Luton & Watford	0.796837	1.042412
22	South West Sussex	0.794487	1.039337
23	York	0.793626	1.038211
24	Essex	0.792906	1.037268
25	Livingston & Bathgate	0.792642	1.036923
26	Falkirk	0.791833	1.035865
27	Ipswich	0.791575	1.035527
28	Berwick, Galashiels & Peebles	0.7902	1.033729
29	Portsmouth	0.790182	1.033705
30	Gloucester, Monmouth & Cinderford	0.79011	1.033612

31	Maidstone & North Kent	0.788514	1.031523
32	Bristol	0.788143	1.031038
33	Poole	0.788091	1.03097
34	Mid Wales Border	0.788018	1.030874
35	Moray	0.785062	1.027007
36	North Devon	0.78494	1.026847
37	Edinburgh	0.78403	1.025657
38	Scottish Border	0.78319	1.024558
39	Rugby, Warwick & Stratford upon	0.782917	1.024201
40	Somerset & East Devon	0.782697	1.023913
41	South Kent	0.78218	1.023237
42	Fife	0.782109	1.023144
43	Brighton	0.781373	1.022181
44	West Norfolk	0.780539	1.02109
45	Dorset	0.78026	1.020725
46	Southend & Brentwood	0.778759	1.018762
47	Huddersfield	0.778385	1.018273
48	Peterborough	0.777024	1.016492
49	Perth & Blairgowrie	0.776936	1.016377
50	South West Scotland	0.775955	1.015093
51	Chestershire	0.775498	1.014496
52	Leicester	0.774432	1.013101
53	Bath	0.77282	1.010992
54	Kidderminister, Worcester & Malvern	0.772037	1.009969
55	Scunthorpe	0.7711	1.008743
56	Exeter & Newton Abbot	0.770374	1.007793
57	Stirling & Alloa	0.769389	1.006504
58	Preston	0.769309	1.006399
59	Derby & Burton upon Trent	0.768986	1.005977
60	Lincolnshire	0.767357	1.003846
61	Wakefield & Castleford	0.766768	1.003076
62	Leeds	0.764488	1.000093
63	North East Yorkshire	0.763824	0.999225
64	Bournemouth	0.763588	0.998915
65	Telford & Bridgnorth	0.762652	0.99769

66	Grimsby	0.762631	0.997664
67	Darlington	0.762419	0.997386
68	Angus	0.761999	0.996837
69	South Devon	0.761634	0.996359
70	Plymouth	0.76157	0.996276
71	Wrexham & Whitchurch	0.761515	0.996203
72	Lanarkshire	0.760361	0.994694
73	East Kent	0.758884	0.992761
74	Nottingham	0.758533	0.992302
75	East Norfolk	0.758021	0.991632
76	Ayr & Kilmarnock	0.756161	0.9892
77	Staffordshire	0.755965	0.988943
78	Dumbarton	0.754371	0.986858
79	Calderdale	0.754026	0.986407
80	Coventry	0.753359	0.985534
81	Isle of Wight	0.753109	0.985208
82	Derbyshire	0.7516	0.983233
83	Walsall & Cannock	0.750482	0.981771
84	Cornwall	0.749738	0.980797
85	Blackpool	0.748446	0.979107
86	Hull	0.745942	0.975831
87	Morpeth, Ashington & Alnwick	0.742397	0.971194
88	Dudley & Sandwell	0.741412	0.969905
89	Cumbria	0.741218	0.969651
90	Manchester	0.740357	0.968525
91	Warrington & Wigan	0.739656	0.967608
92	North Lancashire	0.739504	0.967409
93	Bolton	0.738715	0.966377
94	London	0.737609	0.96493
95	Gwynedd & Conwy	0.737609	0.964929
96	Newcastle & Durham	0.737002	0.964136
97	Pembrokeshire	0.733515	0.959575
98	Doncaster	0.733431	0.959464
99	Irvine & Annan	0.732733	0.958551
100	Mansfield	0.732598	0.958375

101	Wirral & Ellesmere Port	0.732312	0.958
102	Bridgend	0.731837	0.957379
103	Carmarthenshire & Brecon	0.731225	0.956578
104	Rochdale & Oldham	0.73088	0.956127
105	Sheffield & Rotherham	0.73083	0.956062
106	Newport & Cwmbran	0.729987	0.954959
107	Greenock	0.72865	0.95321
108	Middlesborough & Stockton	0.723506	0.946481
109	Anglesey & Bangor	0.72242	0.94506
110	Bradford	0.721905	0.944387
111	Barnsley	0.721858	0.944325
112	Wolverhampton	0.721827	0.944284
113	Rhyl & Denbigh	0.721548	0.94392
114	Cardiff	0.721218	0.943488
115	Birmingham	0.720636	0.942727
116	Glasgow	0.719096	0.940711
117	Blackburn	0.718559	0.940009
118	West Mid Wales	0.710443	0.929392
119	Sunderland	0.707607	0.925682
120	Swansea Bay	0.703942	0.920887
121	Liverpool	0.697202	0.912071
122	Ebbw Vale & Abergavenny	0.696209	0.910772
123	Merthyr Tydfil & Aberdare	0.692081	0.905371
124	Hartlepool	0.689287	0.901716

Table 4.A4

Summary Statistics

Variable	Mean	Std. Dev.	Min	Max
Hourly Earnings	10.46033	6.478015	1.2	53.13
Employed	0.953279	0.211041	0	1
Activity	0.75411	0.430614	0	1
Personal Characteristics				
Male	0.478179	0.499524	0	1
Female	0.521821	0.499524	0	1
Age	40.72369	13.64538	16	64
Age^2	1844.615	1106.463	256	4096
Activity Limiting Health Problem	0.136999	0.343846	0	1
Married	0.352249	0.477671	0	1
Dependent Children under 19	0.760977	1.054175	0	11
Housing Type				
Mortgage	0.535711	0.498724	0	1
Owns Home	0.214783	0.410672	0	1
Council Home	0.148294	0.355392	0	1
Other Rented	0.101212	0.301609	0	1
Ethnicity				
White	0.925294	0.262917	0	1
Mixed	0.00573	0.075479	0	1
Asian	0.038473	0.192335	0	1
Black	0.015309	0.122777	0	1
Chinese	0.003954	0.062756	0	1
Other	0.011241	0.105427	0	1
Qualifications				
PhD	0.008316	0.090813	0	1
Masters	0.028802	0.167249	0	1
PGCE	0.013257	0.114371	0	1
First Degree	0.127983	0.334071	0	1
Higher Education	0.088001	0.283296	0	1
A Level	0.224888	0.417509	0	1
GCSE	0.224355	0.417157	0	1
Other	0.118759	0.323505	0	1
None	0.167297	0.373242	0	1
Employment				
Job Tenure	7.773167	8.471827	0	49
Part Time	0.253184	0.434836	0	1

Full Time	0.746816	0.434836	0	1
Public Sector	0.248494	0.43214	0	1
Private Sector	0.751507	0.43214	0	1
Plant Size under 25	0.36123	0.480358	0	1
Plant Size 25 to 49	0.134295	0.340969	0	1
Plant Size 50 to 499	0.335805	0.472272	0	1
Plant Size over 500	0.168671	0.374462	0	1
Industry Sector				
Agriculture & Fishing	0.01396	0.117325	0	1
Energy & Water	0.011208	0.105271	0	1
Manufacturing	0.14078	0.347795	0	1
Construction	0.079072	0.269851	0	1
Distribution, Hotels & Restaurants	0.193735	0.395224	0	1
Transport & Communications	0.067937	0.251638	0	1
Banking, Finance & Insurance	0.145217	0.35232	0	1
Public Admin. Educ. & Health	0.289861	0.453698	0	1
Other Services	0.058075	0.233885	0	1
Occupation				
Managerial	0.146357	0.353464	0	1
Professional	0.120646	0.325716	0	1
Associate Pro. & Technical	0.137355	0.344222	0	1
Administration	0.12453	0.330186	0	1
Skilled Trade	0.115026	0.319054	0	1
Personal Service	0.082643	0.275342	0	1
Sales	0.076964	0.266535	0	1
Process, Plant & Machinery	0.07938	0.270331	0	1
Elementary	0.117098	0.321538	0	1
Year				
2004	0.502246	0.499995	0	1
2005	0.199456	0.399591	0	1
2006	0.152757	0.359753	0	1
2007	0.145542	0.352646	0	1
Rural				
Method A	0.072349	0.259065	0	1
Method B	0.231311	0.421671	0	1
Method C	0.101011	0.301344	0	1

Chapter 5

The Graduate Premium: Differences by Region and Subject Area

5.1 Introduction

Amidst news of higher education funding cuts, escalating tuition fees and a labour market flooded with graduates, this chapter aims to analyse the financial benefits that come from possession of a degree. Whilst the numbers of students attending universities has risen dramatically over the previous four decades, recent studies show that the graduate premium, which is the additional income that a university graduate can expect to earn over an individual who chose not to attend university, has persisted over this period (Walker and Zhu, 2010). This means that along with the shift in supply of graduates to the labour market, there has been an equal shift in the demand for graduates, driven by the United Kingdom's shift to a knowledge based economy, requiring a more highly skilled workforce.

Due to the recent increases in tuition fees, it is more important than ever that a potential student is aware of the rewards to obtaining a university level education. This chapter examines where graduate premiums are available and in which subjects, industries and employment sectors the greatest graduate premiums are found. This will reveal the routes of possible graduate migration and allow more informed decisions to be made, both on the part of the (potential) student and policy makers, when setting future tuition fee levels.

In this chapter I assess the graduate premium using the Annual Population Survey (APS) between 2004 and 2007. I place particular focus on how the graduate premium varies across NUTS 1 regions in the UK, an important area of research, yet one that has received little attention. This information can be used along with the results on regional wage flexibility obtained in chapter 3 to aid in planning for economic recovery. The graduate premium measures how much possession of a first degree is rewarded and the regional results can be interpreted as providing a measure of regional demand for high level skills. The regional analysis is taken one step further by including a sub-regional analysis, looking at how the graduate premium changes between smaller areas within Wales and gauging how Wales fares in comparison to the UK. I also examine the premium paid to postgraduate qualifications, individual subject areas, industries and employment sectors, and assess the effects of degree classification on the returns to first and higher degrees.

In the following section I present a summary of the literature in this area, in section three the data used is examined and the methodology is explained, in section four results are presented and conclusions are drawn in section five.

5.2 Literature Review

The literature on educational returns tends to focus on either returns to years of education or the returns to qualifications. One major departure between these two methods is that whilst studies that estimate returns to years of education make the assumption that returns are linear and do not differ over years, those that estimate returns to qualifications allow returns to vary over years. This means that years in which qualifications are attained can have greater returns than years in which no qualifications are attained. Whilst this chapter focuses on the premium paid to qualifications, this literature review will also consider the returns to years of schooling. Studies may also calculate the private rate of return, which considers the costs to the individual of educational attainment, and the social rate of return, which accounts for costs incurred by the state.

Early examples of the literature on returns to education built on the human capital theory work by Schultz (1961) and Becker (1964), where educational investment was treated similarly to other types of capital investments (Patrinos and Psacharopoulos, 2011). Much of the returns to education literature has used an augmented Mincer (1974) earnings function, as is used here. Whilst I generally focus on more recent contributions to the returns to education literature, Psacharopoulos (1981) presents a comparison of the returns to education over 44 countries between 1957 and 1978, which summarises the results of many early studies. Both private and social returns are considered, at primary, secondary and higher education levels. Several patterns in the results of these studies are noted: the returns to primary education exceed the returns to secondary and higher education in terms of both private and social returns; private returns to education exceed social returns, with the largest discrepancy at higher education level; returns to education exceed the opportunity cost of capital (which Psacharopoulos places at a yardstick value of 10%); and the rate of return is greatest in developing countries. From these patterns in the results, Psacharopoulos identifies four policy implications: that returns suggest that the greatest focus should be placed upon primary level education; that returns to both secondary and higher education provide a large enough social benefit that they should be pursued with primary education in a 'programme of balanced human resource development'; students could contribute financially towards a university level education, due to the large private returns; and that although developing countries have greater rates of return to education, the difference is relatively small.

Belman and Heywood (1991) examine sheepskin effects for women and minority men using data from the May 1987 Current Population Survey (CPS), hypothesising that signalling effects of holding a higher qualification are greater for women and minority men than white males. A spline function is estimated, with years of education split at 8 and 12 years. Dummy variables are also included for years of schooling greater than 8, greater than 12, greater than 16, equal to 17, and equal to 18. Results for black males are compared to white males, with the graduate premium for black males more than twice that of white males. Black males also receive a higher degree premium, where white males do not. These effects support their hypothesis of black males benefiting more from signals of higher productivity. Additionally, no high school premium is found for black males, but one is found for white males, which fits their signalling hypothesis. Results for black women fit the signalling hypothesis well, with large returns to first degrees and higher degrees, and insignificant returns to lower qualifications. Belman and Heywood find that white women are a middle ground between white men and racial minorities, as their results fit the signalling hypothesis, but not as well as black men and women. White women receive large returns to higher degrees, but also to high school.

Blundell *et al.* (1997, 2000) use data from the British National Child Development Study (NCDS) to estimate the effects of degree possession in the medium to long term. A cohort born between the 3rd and 9th of March 1958 was selected and was surveyed several times, the most recent being in 1991, when respondents would have been 33 years old. This dataset contains the results of maths and reading tests undertaken at seven years old, which are used to control for ability. Relative to A level holders, Blundell *et al.* report returns for men (women) of 15% (26%) for non-degree higher education qualifications, 21% (39%) for first degrees and 15% (43%) for higher degrees, although the magnitudes of these premiums decrease as more controls are added to the specification. The large discrepancy between the graduate premiums of men and women again supports the notion that women benefit more from holding degree level qualifications. Blundell *et al.* find that as qualification levels increase, the gender pay gap narrows. Splitting the sample by subject, they find the greatest returns, for both men and women, to be found in economics, accountancy and law, whilst the lowest returns are found for those whose degrees are in the areas of chemistry and biology. Blundell *et al.* theorize that the premiums associated with particular subjects are due to either subjects attracting different qualities of students (through their level of entry requirements) or that students are motivated by studying a subject with a high level of estimated returns, which increases their productivity. Blundell *et al.* are able to test the effect on earnings of non-completion of a higher education course. They find that men who began, but failed to complete a higher education course suffered a 9% penalty relative to those who had never attempted a higher education course. They theorize that this effect may be due to time taken out of the labour market (resulting in lower labour market experience) or a negative signalling effect. There is no penalty to non-completion for women. They also test the effect of starting a higher education course aged 21 or older. Men are found to pay a penalty of between 7% and 8% relative to those who started their higher education course before the age of 21. Again, there is no penalty found for women. Blundell *et al.* also examine the effect that higher education has on employment. They find that whilst there is no observable effect of higher education on the employment prospects of men, women with a higher education qualification are 8% more likely to be employed than those with just A levels.

Blackaby, Murphy and O'Leary (1999) use the Labour Force Survey between 1993 and 1995 to explore the differences in the premium paid to different subjects, amongst other issues. They calculate the rate of return to a first degree, relative to an individual with no qualifications, to be 88.9% for men and 112.5% for women. Returns for women are also significantly higher than men for higher degrees, other degree level qualifications and diplomas in higher education, again confirming that women benefit more from higher education. To look at the differences between subjects, Blackaby, Murphy and O'Leary first create twelve broad subject groups. Comparing these groups to persons educated up to A level, they find that all subject areas offer significant positive returns. For both men and women, medical subjects carry the greatest rewards. Outside of medical subjects, the largest rate of return for men (women) is found in the subject area of economics, accountancy, law and management (architecture and building), whilst the smallest is found for arts (other social sciences). For all subjects, female returns exceed those for men. There also appears to be less variation in the graduate premium across subjects for women. This effect remains when the broad subject groups are split into over one hundred more detailed subjects. For men, the broad subject group of economics, accountancy, law and management provided the greatest rate of return (apart from medical studies). By splitting the subjects into finer areas, they find that accountancy is the main driving force behind that result. Blackaby, Murphy and O'Leary conclude that choice of subject is far more important for men than it is for women, with the large variation in the graduate premium over subject areas holding over both broad and finer subject classifications.

The National Child Development Study (NCDS) is used by Dearden (1999) to estimate the returns to years of education for 33 year old men in 1991. The NCDS dataset contains information on family background and ability (tested at age 7), which is not available in the majority of datasets. This information causes Dearden to explore the determinants of years of education. Regarding ability, high ability men are found to stay in education longer than low ability men, with the effects for reading ability slightly higher than mathematics ability (0.97 years to 0.65 years). School type also has an effect on years in education, with those who attended grammar or private schools staying in education for 1.03 and 1.39 years more than men who attended a comprehensive school. Regarding family background, time spent in education increases for men with more educated parents, fathers who work in highly skilled jobs (mothers occupation has no significant effect on years of education), and parents who have shown an interest in their child's education. Financial difficulties in the family are shown to have a negative effect on years of education. When estimating the effect of years of schooling on earnings, a return of 4.8% is found. Dearden notes that controls for family background and ability are very important, and that OLS returns are significantly higher without them. Evidence of heterogeneity in the returns to education is found, showing that those with less taste for education have higher returns to an additional year of education, with returns decreasing by 0.55 percentage points for each additional year of father's schooling.

A meta-analysis by Ashenfelter *et al.* (1999) reviews estimates for returns to schooling, paying particular attention to the effects of publication bias. A dataset of 96 estimates of the return to schooling, from 27 studies, covering 9 countries is used, with the sample being divided into OLS, IV and twin studies. They find that estimation methods differ in the returns to education produced, with IV and twin studies producing estimates 3 and 1.6% greater than OLS. Testing for publication bias suggests that IV studies do suffer from publication bias. Correcting for this bias lowers the return to education for IV studies (.086 to .081), but this still exceeds OLS estimates (0.64). Ashenfelter *et al.* conclude that after controlling for the likelihood of reporting a result, differences between estimation methods are relatively small.

Harmon and Walker (2000) explore the effects of quality and quantity on the returns to education. They hypothesise that high returns to schooling may be due to the correlation between quantity and quality of education. A high quality of education may result in individuals undertaking less education, as they are able to reach a high level of productivity quickly, whilst the high quality of education may convince individuals to undertake more education, because it is of a very high quality. Data for their study is taken from the National Child Development Study (NCDC), focusing on men aged 33 in 1991. This dataset allows them to control for ability differences, by using the results of ability tests in mathematics and English at age 7. Their basic specification reveals returns to schooling to be around 5% and that mathematics and English ability have the same effect on earnings. Harmon and Walker estimate the returns to education by school types, using comprehensive schools as a baseline. Years of schooling at secondary modern, grammar or private schools are found to have no significant effect over comprehensive school. Regarding ability, they find results that do not concur with the theory that selective schooling levels allow children to achieve the most that their ability level will allow. High ability children who fail to gain entry to a grammar school and who attend a secondary modern school do better than others in secondary modern schools and low ability children that do gain entry to grammar school do better than those of high ability. IV regression causes the returns to years of schooling to double relative to OLS, from 5% to 10%.

The suitability of the schooling coefficient in the Mincer earnings function to approximate the marginal internal rate of return to education is assessed by Bjorklund and Kjellstrom (2002). Data for men from 1968, 1981 and 1991 is used, taken from the Swedish Level of Living Survey. The Mincer earnings function is extended, firstly using a Box-Cox transformation, and secondly, by applying the Box-Cox transformation and including dummy variables for years of education and interactions between education and experience. Results suggest that Bjorklund and Kjellstrom's extended models are more appropriate to use than the standard Mincer earnings equation. The return to schooling in Sweden is found to have fallen between 1968 and 1981, which Bjorlund and Kjellstrom attribute to a fall in the graduate premium, as the returns to high school have remained stable.

McIntosh (2002) uses the Labour Force Survey (LFS) between 1993 and 2001 to calculate the earnings premium. His methodology differs from most other studies in that he uses all qualifications held by an individual, rather than just their highest qualification. This allows the rates of return to specific degrees to be added together to calculate the return to specific combinations of qualifications. McIntosh identifies a potential problem: respondents in the LFS are only asked for their highest three qualifications prior to 1996. This causes the returns to high level qualifications to be biased upward prior to 1996. This is seen in the results, as the rate of return to a higher degree falls by 15 percentage points between 1995 and 1996, due to the inclusion of all qualifications. McIntosh finds that, for men, possession of a first degree increases earnings by between 24% and 28%, relative to an individual who does not have a first degree, all other qualifications held constant. Other higher education qualifications and higher education diplomas have rates of return of between 5% and 10% and between 2% and 8%, far below that of degrees. Interestingly, McIntosh finds no evidence that women benefit more than men from obtaining a degree. Their rate of return is between 25% and 27%, which is very similar to men. It is found that women benefit more than men from teaching and nursing qualifications, with the returns to these qualifications increasing with age. Comparing the graduate premium over the sample years, it is found to vary very little, showing just slight growth. By splitting the sample by sector, McIntosh finds the return to a degree to be far greater in the private sector compared to the public sector, for men (29% to 17%). Whilst the difference between these returns is significant, the difference between returns to a degree for women in the public and private sectors is statistically insignificant (25% to 30%). McIntosh also analyses the graduate premium using pseudo cohorts, based on age. He finds that the rate of return to holding a degree rises whilst the individual is in their twenties, before stabilizing in their early thirties and remaining relatively stable throughout the rest of their working lives.

Estimates of the returns to schooling in 28 countries are calculated by Trostel *et al.* (2002). To make estimates comparable over such a large number of countries, data from the International Social Survey Programme between 1985 and 1995 is used. By pooling the sample, a worldwide estimate of the returns to education of 4.8% for men and 5.7% for women is found. Disaggregation by country produces a wide variety of estimates, peaking at 19.2% for women in the Philippines, and falling to 1.9% for females in the Netherlands. Trostel *et al.* note that there are no obvious explanations for the wide variety of results. Examination of the data reveals there to be little correlation between the returns to education and per capita income, average educational attainment or the percentage of gross national product spent on education. They do note that the high estimates for Great Britain and Northern Ireland may be biased upwards due to schooling being truncated between 10 and 14 years in the data for these countries. The use of IV estimation methods produces returns to education that exceed OLS returns by around 20%. Trostel *et al.* include a trend interacted with schooling to examine how the returns to education have changed over time. Results vary greatly by country, but worldwide pooled results suggest that returns to schooling are declining slightly, with the larger effect found for women.

Bonjour *et al.* (2002) focus their returns to schooling research on UK twins, using the results of a questionnaire they administered to twins on the St. Thomas' UK Adult Twin Registry. Their sample consists of 428 individuals (214 pairs), all of whom are women. Years of education are assigned to different qualifications. Using OLS methods, Bonjour *et al.* find a return to schooling of 7.7%. To control for the problem of measurement error on schooling, they instrument using the education level of the other twin, increasing the return to schooling from 7.7% to 8.5%. Bonjour *et al.* also find that omitted ability causes results to be biased downward and that measurement error biases education returns upward.

Sloane *et al.* (2003) calculate the returns to qualifications for Wales and for Great Britain as a whole, using the Labour Force Survey (LFS). Net and gross earnings are used as dependent variable, measured both hourly and weekly. Male returns are found to be highest using gross hourly earnings, whilst women find their greatest returns for gross weekly earnings. Returns using net earnings are estimated to be significantly lower than gross returns, which Sloane *et al.* note to be consistent with progressive taxation. They find that over the sample period, the returns to qualifications have fallen, which is more apparent for women than men. Returns vary greatly according to subject area of degree, with the largest returns by far found for medicine (although the duration of medicine degrees would account for much of the difference). Outside of medicine, the largest returns for men result from degrees in mathematical sciences and computing and law, whilst women find their greatest returns in the subject areas of architecture, law, education and mathematics and computer science. Over time, the variation in returns by subject of degree has fallen. From their Welsh sample, Sloane *et al.* calculate that male Welsh returns to first and higher degrees are lower than for Great Britain as a whole, but for women they are slightly higher. Calculating the graduate premium over unitary authorities, the largest return for men is found in Flintshire, and in Carmarthenshire for women.

Austria has seen a large expansion in higher education over the past 3 decades, with a sharp rise in the supply of graduates. Fersterer and Winter-Ebmer (2003) use the Austrian Mikrozensus between 1981 and 1997 to examine how the returns to education have responded. Initially, years of schooling are used, but they also use qualification dummies to allow for non-linear returns to education. At the start of the sample period, returns to schooling for women are around 2 percentage points higher than for men, but returns are found to have equalised by 1997. Returns for both men and women are found to have fallen over the sample period, consistent with the large rise in graduates. A Heckman correction for sample selection is used, but male results are found to be the same with and without sample selection, and returns for women are only 0.4 percentage points lower after correcting for sample selection. Using qualification dummies, the largest decrease over the sample period is in the graduate premium, with the fall in female returns greater than the fall in male returns. A quantile regression is also used, finding that returns to education are greater at the higher end of the earnings distribution, larger differences between the 10^{th} and 90^{th} percentiles are found for men than women, and that the decreases in the returns to education are similar across the earnings distribution.

Bratti and Mancini (2003) look at the graduate premium of male UK graduates between 1980 and 1993. They utilize three models: a 'proxying and matching' method (ordinary least squares), a propensity score matching method, and a simultaneous equations model of earnings determination and subject choice (maximum likelihood). Data is from the Universities' Statistical Record (USR) on students who graduated from university between 1980 and 1993. The USR data does not contain earnings information. Instead, earnings are matched in from the

New Earnings Survey (NES) according to three digit SOC codes, by year. They group subjects into five broad groups: science, hi-tech, economics and business, humanities and other social sciences, and a group of the remaining subjects (economics and business is used as the reference group). Bratti and Mancini's OLS results show that economics and business graduates have a greater rate of return than the other subject groups. These results also reveal that the graduate premiums of these subject groups are fairly close for the 1980 cohort, but variation increases through time. The ranking of subject groups following economics and business is: hi-tech, science, and humanities and other social sciences. In the propensity score matching model, economics and business again display the greatest graduate premium. Compared to OLS, the gap between economics and business, and science and hi-tech is wider, but the gap with humanities and other social sciences is reduced, to the point that the rate of return to humanities and other social sciences exceed that of science and hi-tech for some of the years considered. The results of the maximum likelihood model differ from those found by the OLS and propensity score matching models. They find strong evidence that (in most years) hi-tech results suffer from positive selection bias, so OLS and propensity score matching premia are biased upwards. In the maximum likelihood model, the earnings premium of science graduates exceeds that of economics and business graduates for some years. The volatility of these results cause the rankings found in the previous models to disappear here.

Chevalier (2003) examines variation in the graduate premium due to the prestige of the university attended. He splits universities up into three categories: Russell group universities, old universities (pre 1992) and new universities, which display statistically different A level intake scores, staff-student ratios, research assessment scores and destinations of graduates. Quality is highest in Russell group universities and lowest in new universities. Data from the Graduate Cohort Studies of 1985, 1990 and 1995 is used. Chevalier first estimates the effect of university quality using a linear specification. Relative to modern universities, the premium for Russell group universities is between 9% and 12%, whilst the premium for old universities is between 3% and 8%. The quality premium is found to increase with the more recent cohorts. Chevalier expands this initial specification by using a propensity score matching model. Analysis of the propensity scores over time reveals that average ability in both Russell group universities and modern universities has fallen, as Russell group universities have recruited the best students from modern universities and modern universities have attracted lower ability students during the higher education expansion. Chevalier finds that the quality premium increases over cohorts. Testing whether the quality premium is correlated with ability or family background, Chevalier focuses on two Russell group universities and finds that the quality premium is not correlated with family background or ability, suggesting that the quality premium is due to improved teaching. Examining wage growth across cohorts, Chevalier determines that the university attended has no effect on wage growth, but that the human capital acquired at university results in a constant positive earnings effect.

Using the Labour Force Surveys of the UK and Germany, Machin and Puhani (2003) explore the effects on the gender wage gap of controlling for subject of degree. Grouping subjects into broad categories, they find that men are more likely to study engineering, technology and physical/mathematical sciences, which tend to be well paid, whilst women are more likely to enrol in subject areas with lower returns, such as languages, humanities, creative arts and education. The gender wage difference for graduates is larger in Germany than the UK (.280 to .208), which Machin and Puhani attribute to women being more advanced on the wage hierarchy in the UK than Germany. In their preferred specification, broad subject areas account for a 2% male wage premium, which increases to 4% (for the UK) when a more detailed breakdown of subject is used. This represents between 8 and 20% of the overall gender wage gap, confirming the importance of degree type.

Black *et al.* (2003) place their focus on the premium paid to obtaining a degree in economics. Using the 1993 National Survey of College Graduates (NSCG), they construct 85 subject majors and use economics as the excluded group, so the returns to all other majors will be measured relative to economics. Focusing initially on those who just have an undergraduate degree, the importance of separating economics from other social sciences is clear in their results, as those who major in economics are found to earn 13% more than those whose undergraduate degree is in other social sciences. They find that the only major that displays a substantial earnings advantage over economics is engineering. By splitting their sample into three age cohorts (25-34, 35-44 and 45-55), they find that the gap in earnings for elementary education, history, English and foreign languages compared to economics has increased for the youngest cohort. Comparing economics to five groups of majors using quantile regression techniques, Black *et al.* find that the earnings gap between economics and business administration, political science, and history is fairly stable across quantiles, remaining between 10% and 20%. However, at lower levels of the earnings distribution, those with first degrees in accounting and, especially, electrical engineering display a significant earnings advantage over economics. The earnings advantage of electrical engineering remains until the 80^{th} percentile. At the 90^{th} percentile, both accounting and electrical engineering display an 11% earnings disadvantage relative to economics. Black *et al.* also examine the role of economics as a precursor to postgraduate study. Undergraduate subject choice is found to be extremely important to the choice of whether to continue into postgraduate education. They find that around 45% of economics graduates will pursue a postgraduate degree, which Black *et al.* consider to be 'middle of the pack'. This figure is exceeded by subjects such as biology, chemistry, maths, physics, history and English. Looking at the earnings of those with an MBA, Black *et al.* find that economics graduates enjoy an earnings advantage over all other undergraduates, except for those who studied chemical engineering. They suggest that the high earnings of engineering students are due to the highly valued skills they acquire as part of their degree course.

Heckman *et al.* (2003, 2008) use a nonparametric approach to estimate the marginal internal rate of return to education for men using the US decennial Census and the Current Population Survey between 1940 and 2000. They believe that the Mincer (1974) earnings function is unsuitable for estimating the marginal rate of return, as it ignores several factors, such as income taxes and time out of the labour market. Testing this theory, they find that results obtained using a Mincer earnings equation are biased downwards, with a large difference in the returns to high school completion. Returns to high school completion rose sharply between 1970 and

1990, whilst there were rises in the graduate premium between 1980 and 2000. Bias is found to be less when estimating the graduate premium using a Mincer earnings function, than when estimating the returns to high school completion. Comparing Mincer and nonparametric methods, estimates tend to be within five percentage points of each other. Heckman *et al.* note that the Mincer model is supported by data between 1940 and 1950, but by the 1980s data seems to reject the Mincer specification. In addition, Heckman *et al.* provide support for taking a cohort based approach opposed to a cross sectional approach, as they believe that cross section data will produce biased estimates in times of economic transition, if individuals cannot foresee differences in the price of skills.

Leslie (2003) focuses on the quality of students. Leslie theorizes that the most talented students self-select into the more difficult subjects, which have higher entry requirements and offer greater returns. Leslie uses data from the Universities College Admissions Service (UCAS) to create a measure of student quality across 21 broad subject areas and 170 specific subject groups. Measures of quality for subjects are expressed between zero and one, where a score of one suggests that all persons accepted onto the course possess top ranked qualifications and a score of zero means all students that enrol on the course have the lowest ranked qualifications. Using the UCAS data, Leslie finds a correlation between the quality of applicants to a subject and the quality of acceptances to the subject of 0.93, which confirms the theory that the most talented students self-select into more difficult subjects. As expected, the quality of acceptances exceeds those of applicants. The UCAS data contains information on both HND as well as degree courses, with Leslie finding that (in terms of acceptances) the highest ranked HND group is below the lowest ranked degree group. Among Leslie's finding are that those who study education as an undergraduate degree possess a low quality score, those who do not specify a preferred subject are ranked last, there is very little difference in quality between those that enrol on single subject and combined subject degrees, specific subjects tend to consist of students of greater ability than broad subject areas (for example, chemical engineering compared to general engineering), and pure subjects display a greater quality score than applied subjects (for example, physics compared to environmental sciences). The importance of separating economics from other social sciences is again observed, as economics ranks 20th, whilst sociology ranks 115th. Economics is found to attract more capable students than law and business.

O'Leary and Sloane (2005) calculate the premium paid to first degrees, masters degrees and PhDs using the Labour Force Survey (LFS), over the period 1994 to 2002. This study breaks from the conventional approach of using a dummy variable indicating highest qualification within a single equation by utilising a multi equation approach. This methodology builds on Blinder and Oaxaca's (1973) decomposition framework, which allows the difference in mean hourly earnings between two subjects to be split into components due to characteristic and ability differences, and due to the way the labour market rewards these factors. O'Leary and Sloane's results confirm that, compared to a baseline of no qualifications, possession of a degree will benefit women far more than men, a result they use to explain the greater numbers of women enrolling in higher education. Whilst returns at degree level (including degree equivalents and higher degrees) favour women, returns at GCSE and A level are greater for men than for women. Estimating the earnings premium relative to persons who could have gone to university (those who have two or more A levels), returns for women exceed those for men at all degree levels (undergraduate, masters and PhD), and by a large margin. Comparing the mark-up of broad subject areas at first degree level relative to a first degree in arts, the largest returns are found in the subject areas of maths and computing, medicine and related, and engineering for men, and medicine and related, maths and computing, and education for women. Splitting broad subject areas into smaller groupings, they find accountancy to offer the greatest premium relative to arts for both men and women. O'Leary and Sloane also calculate the expected increase in lifetime earnings of degree holders compared to those with two or more A levels, finding a lifetime earnings advantage of £141,539 for men and £157,982 for women. There is considerable variation available amongst subjects, ranging (for men) from £22,458 for arts degree holders to £222,419 for those with a degree in maths and computing. Finally, O'Leary and Sloane estimate the returns to higher degrees (masters and PhDs) by broad subject groups relative to an undergraduate degree in the same subject area. At masters level, the greatest returns are found for business and financial studies for both men and women (14.34% for men and 19.52% for women).

At PhD level, men find their greatest returns for business and financial studies, whilst women find their largest premiums in the combined group, followed by medicine and related studies. Whilst all returns for women are positive relative to the A level group, for men, negative returns are found for maths and computing, and languages at masters level, and architecture and related, and education at PhD level, although none of these results are significant at the 10% level. Also, for several subjects, the returns at doctoral level are lower than those at masters level.

Whilst there has been relatively little evidence on differences in the graduate premium over regions, the issue has been explored by O'Leary and Sloane (2008). Using the Labour Force Survey between 2000 and 2004, university graduates are compared to holders of two or more A levels, over Government Office Regions (equivalent to NUTS 1 areas, as used in this study). Firstly, they look at the share of graduate employment to total employment, by region, finding a large clustering of graduate employment in London and the South East, whilst the North East has the lowest ratio of graduate employment, followed by the East Midlands. Estimating the graduate premium relative to A level holders in the West Midlands, the largest premium is found in London, followed by the South East and the East of England. Both nominal and real earnings are used, which alters the size of the regional graduate premiums and changes the rankings of regions (although London remains at the top of the rankings). For example, Wales offered the lowest graduate premium to men when using nominal earnings, but a higher cost of living forces the South West to the bottom of the rankings when using real earnings. Comparing the results for men and women, there is little similarity outside of the South Eastern regions, although female premiums generally exceed male premiums, supporting the notion that women benefit more from obtaining a degree than men. O'Leary and Sloane also estimate regional graduate premiums relative to A level holders within the same region. This causes the London premium to shrink so much that the graduate premium in London is smaller than in any other region and premiums across the generally high earnings South Eastern regions also decrease dramatically. Relative to A level holders within the same region, the largest graduate premium for men is found in the East Midlands and in Scotland for women. O'Leary and Sloane look at the determinants of regional graduate performance, focusing on differences in occupational and industrial structure. London is found to have the largest percentage of managers and senior officials; however, they do not believe that occupational structure is the main determinant, due to high earnings in some regions with poor occupational structures. Examination of industrial structure reveals a large percentage of persons employed in the banking, finance and insurance sector in London, three times larger than in Wales. In Wales, the public administration, education and health sector dominates, although O'Leary and Sloane do not believe that more similar industrial structures would remove the regional differences in the graduate premium. Decomposition analysis reveals that, for both men and women, the coefficient effect is greater than the composition effect, suggesting that the cause of regional disparities in the graduate premium is the regional differences in how personal characteristics are rewarded.

Walker and Zhu (2008) use the Quarterly Labour Force Survey (LFS) over the period 1994 to 2006 to calculate the graduate premium in the UK. Their main focus is on the change in the graduate premium over this time period and over birth cohorts. Walker and Zhu address the issue that the expansion of the UK higher education system may have resulted in high ability non-graduates becoming low ability graduates, resulting in the lowering of mean ability across both groups. To counter this problem, they use quantile regression techniques, so that the graduate premium is estimated at different points along the wage distribution. In the top quartile, they find a fall in the graduate premium for both men and women between the pre and post expansion cohorts (the pre expansion cohort consists of those who were aged 19 up to 1987 and the post expansion cohort consists of those up to 19 in 1993). At the median, there is an increase for men and a fall for women (although these changes are statistically insignificant). A large change is found for men in the lower quartile, as the graduate premium fell by 15%. Women see a small rise in the bottom quartile (although these differences are again insignificant). Walker and Zhu's findings suggest that those at the top of the earnings distribution (who would have the highest unobserved skills), have seen their premium increase, but they would have attended university anyway. It is those at the lower end of the distribution who have benefitted from the expansion of higher education, resulting in a fall in average ability for this group and a corresponding fall in the graduate premium for men).

The effects of university quality on the graduate premium are explored by Hussain *et al.* (2009). For earnings data, they use the Graduate Cohort Study (for 1985, 1990, 1995 and 1999), with wages recorded 3 to 6 years after graduation (depending on cohort). Data from the Higher Education Statistics Agency is used to construct five measures of institutional quality: research assessment exercise (RAE) score; faculty-student ratio; retention rate; total tariff score; and mean faculty salary and expenditure per pupil. Hussein *et al.* point out how most prior studies use a single measure of university quality, which is insufficient, as institutional quality is multi-dimensional, so multiple measures are more appropriate. All of the above measures, except for mean faculty salary, are found to have a positive and significant effect on earnings (when included separately). Factor analysis and IV methods are used when including multiple quality measures. They find that using just one quality measure results in downward bias in earnings regressions, with the coefficient on university quality varying between 2.99 and 4.68 when a single measure is used, compared to 4.19 to 9.91 when multiple quality measures are included together. Examining the effects of institutional quality across the cohorts, Hussain *et al.* find that the returns to university quality have increased over time, which they suggest is due to the expansion of higher education. A quartile regression approach suggests that institutional quality has a non-linear effect on earnings, with the greatest effects found for those in the highest quartile.

Walker and Zhu (2010) examine the graduate premium in the UK, looking at the effects of subject choice, classification of first degree and postgraduate qualifications. Data used is from the Labour Force Survey (LFS) between 1994 and 2009. They group subject areas into four broad categories: STEM (science, technology, engineering and medicine), LEM (law, economics and management), OSSAH (other social sciences, arts and humanities) and combined degrees. Male returns are found to be largest for LEM graduates, far above STEM returns. There is much variation across subject groups in the returns for men, far more so than for women. The largest returns for women are also found in LEM. Degree classification is found to have a large effect, particularly for LEM graduates, however, the difference between a first class degree and an upper second class degree tend to be insignificant. The greater effect is for an upper second class degree relative to a lower second class degree. Postgraduate degrees are also found to have a significant effect on earnings (above that of holding an undergraduate degree). The effect is found to be between 5% and 10% for men (highest for LEM and combined subjects) and is larger for women at around 15%. Walker and Zhu are surprised to find that the graduate premium does not vary by region.

O'Leary and Sloane (2011) revisit the graduate premium, focusing on the supply and demand of graduates, using data from the LFS between 1997 and 2006. Estimates of the graduate premium are calculated across the wage distribution. The mark-up to a degree appears greater in the lower tail of the wage distribution, although the difference between the lower and upper quartiles is insignificant. The difference in the graduate premium between genders is also clear, as women have greater returns than men across the wage distribution. Dividing graduates by subject area of degree confirms that the difference between the lower and upper quartiles is statistically insignificant. O'Leary and Sloane also calculate the graduate premium according birth cohort. Relative to the pre 1950 birth cohort, there are positive returns for male birth cohorts between 1950 and 1979 at the median and upper quartile. Differences are noted for the male post 1979 birth cohort. At the upper quartile, there is still evidence of increasing returns, however, in the lower quartile, returns decline relative to earlier birth cohorts (estimates at the median are statistically insignificant). Significantly lower returns are found for women at the median and lower quartile. A smaller decline in returns is also found for women in the 1970-79 birth cohort. Examining returns over birth cohorts disaggregated by subject area reveals increases for men in medicine and related subjects, and education, but falls in sciences and business and finance. They note that the popularity of business and finance subjects may have led to demand falling behind supply. Many subject areas for women show declining returns, particularly in social sciences, and business and finance.

5.3 Data & Methodology

To examine regional differences in the graduate premium the Annual Population Survey (APS) is used. The APS combines the Quarterly Labour Force Survey (QLFS), Local Area Labour Force Survey (LALFS) and the Annual Population Survey Boost (APS(B)).[43] This increased sample size makes examination of smaller sub samples possible, a feature that this chapter takes advantage of, disaggregating by region, subject area, qualification level and degree class amongst other sub samples.

The sample is restricted to those aged between 25 and 64. By the age of 25, most will have completed their first degree and should have been able to find a job with a salary that will reflect their human capital investment. The sample is split between males and females in an attempt to understand how the private returns to a university level education vary by gender. Previous studies tend to show that females benefit more from attaining a degree than males, an understanding I hope to add to by making use of the strengths of the APS. When looking at earnings, hourly figures are used. The dataset covers the period 2004 to 2007, although some regressions have to exclude early periods of data due to missing values, particularly with class of first degree[44] (sample sizes are included in results tables).

I will now examine mean hourly earnings for males and females across relevant sub samples. A table of general summary statistics is included in the appendix (table 5A.1). All summary statistics are produced using population weights. Mean hourly earnings for men are £13.43 and £10.50 for women. The sample includes both full and part time workers. As women account for a greater proportion of part time workers than men (41.35% of female workers are part time compared to just 5.15% of males), this causes the earnings gap between men and women to appear exaggerated. Looking at just full time earnings, this gap closes slightly with male full time earnings averaging £13.63 compared to £11.55 for females. Table 5A.3 in

[43] The APS(B) was only carried out in 2004 and 2005.

[44] This is unavailable in 2004 and only partially available in 2005.

the appendix shows that the proportions of persons working in full time occupations remains relatively stable over educational attainment levels, with those with no qualifications displaying the greatest proportion of part time workers. Full time proportions for men show little variation over UK regions (see table 5A.4). There is more variation across regions for females, with London possessing the greatest proportion of full time female workers (72.87%). The inclusion of part time workers is controlled for in regressions through the use of a part time employment indicator variable.

Table 5.1 shows mean earnings for males and females according to the highest qualification they possess.[45] The numbers of males and females with each qualification level is included. As expected, those possessing a higher level of qualification earn the most and men earn more than women at all qualification levels. Men and women with a first degree earn more than double per hour what those with no qualifications earn, and those who possess a PhD earn around twice as much as those educated to GCSE level. The earnings jump from first degree to masters is larger for women than men (£2.22 per hour to £1.79), but men still earn almost £3 per hour more than women at masters and PhD level. Figures suggest that women benefit from the possession of a PGCE qualification relative to their first degree, but male PGCE holders earn less than those whose highest qualification is a first degree. Despite this, male PGCE holders still earn more per hour than female PGCE holders (£16.73 to £15.01).

Table 5.2 shows highest qualification by gender. Regarding the highest attainment levels of males and females, at first degree level the proportions for both men and women are fairly similar. However, 33.25% of men possess A Levels compared to just 18.47% of women. This is reversed at GCSE level as 19.40% of males are educated up to GCSE level compared to 30.75% of women. Given the higher

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[45] In addition to the qualifications presented above, respondents can also state that they hold 'other' qualifications or they don't know which qualifications they possess. Respondents in these categories are excluded from this sample.

Table 5.1

Mean Hourly Earnings by Highest Qualification

	Male		Female	
	Hourly	**N.**	**Hourly**	**N.**
PhD	20.70	1,388	17.98	733
Masters	19.39	4,007	16.61	3,187
PGCE	16.73	1,214	15.01	2,481
First Degree	17.60	13,905	14.49	14,497
Higher Educ.	14.13	10,419	11.46	14,649
A-Level	11.81	28,272	9.29	17,435
GCSE	10.94	16,502	8.28	29,021
None	8.27	9,613	6.47	12,673

Notes: mean hourly earnings are expressed in £s; N. is the number of individuals with each level of highest qualification.

Table 5.2

Proportion of Highest Qualification by Gender

	Male (%)	**Female (%)**
PhD	1.55	0.72
Masters	4.52	3.23
PGCE	1.37	2.52
First Degree	16.35	15.36
Higher Education	12.25	15.52
A Level	33.25	18.47
GCSE	19.40	30.75
None	11.30	13.43

Notes: proportion of each gender according to highest qualification, expressed as percentage earnings enjoyed by those educated to A Level, this may contribute to the higher earnings of men relative to women. Women also have a slightly higher percentage of persons with no qualifications (13.43% to 11.30%). Regarding higher qualifications, a larger percentage of men are found to hold PhD and masters level qualifications (1.55% to 0.72% and 4.52% to 3.23%), but more women possess PGCEs (women benefit more than men from possession of a PGCE relative to a first degree).

Much of the focus of this chapter concerns the private returns attributable to the possession of a first degree. One recent addition to the APS is the inclusion of a question regarding the degree class attained for a first degree.[46] Table 5.3 presents mean earnings by first degree classification. As with table 5.1, mean hourly earnings are as expected, with earnings decreasing with degree class and men earning more per hour than women at all degree classes. Mean earnings peak at £19.60 per hour for men who attained a first class degree. Table 5A.3 in the appendix shows that the proportion of workers in full time occupations varies very little over qualification levels, so this is unlikely to exert much influence on mean earnings.

Subject area of degree is split into twenty distinct subject areas.[47] This allows the identification of which subject areas drive the graduate earnings premium. Table 5.4 gives mean hourly earnings for men and women with a first degree by subject area. For ease of analysis the rank of subject areas by hourly earnings has been included. For both men and women, hourly earnings are highest for those who studied medicine and dentistry (£22.83 for men, £19.76 for women). Whilst this result is not surprising, it may be somewhat misleading. Whilst those who studied medicine and dentistry may earn more per hour than those who studied other subjects, this may be reflecting that many degrees in medicine and dentistry require a greater time commitment than the three years required by the majority of first degrees. For men,

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[46] The majority of data on degree class comes from the 2006 and 2007 surveys, with limited data available from 2005.

[47] Due to a change in subject classifications between 2004 and 2005, we only use subject area data between 2005 and 2007.

Table 5.3

Mean Hourly Earnings by Degree Class

	Male		Female	
	Hourly	N.	Hourly	N.
First	19.60	703	16.08	683
Upper Second	18.72	2,083	15.54	2,589
Lower Second	17.51	1,569	14.45	1,679
Third	16.71	304	13.62	159

Notes: mean hourly earnings are expressed in £s; N. is the number of individuals within each class of first degree

Table 5.4

Mean Hourly Earnings by First Degree Subject Area

	Male			Female		
	Hourly	R.	N.	Hourly	R.	N.
Medicine & Dentistry	22.83	1	141	19.76	1	203
Medicine Related	16.00	14	306	14.47	12	1,444
Biological Sciences	15.44	17	630	13.79	15	931
Veterinary & Agricultural	15.69	15	141	12.89	17	133
Physical Sciences	17.90	9	1,064	14.95	8	437
Maths & Computing Science	18.74	5	1,212	16.14	5	430
Engineering	18.91	4	2,059	16.50	4	143
Technologies	16.56	11	150	12.75	18	72
Architecture	18.03	8	487	15.23	7	138
Economics	20.94	2	373	16.59	3	167
Politics	18.23	7	161	14.38	13	119
Social Studies	16.44	12	496	13.70	16	1,010
Law	20.25	3	416	17.31	2	500
Business Administration	18.28	6	1,354	14.64	9	1,326
Mass Communications	13.85	19	150	12.72	19	239
Linguistics & Classics	15.56	16	246	14.52	11	597
Language & Literature	16.27	13	165	14.55	10	351
History & Philosophy	15.03	18	560	13.92	14	549
Arts	13.81	20	579	12.15	20	775
Education	16.92	10	376	15.31	6	1,335

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to first degree level in each subject area; R. is the rank of subject areas in order of mean hourly earnings.

the hourly earnings from an economics degree follow medicine and dentistry at £20.94. Law also offers high earnings (£20.25). For women, the highest hourly earnings (after medicine and dentistry) also come from first degrees in the subjects of law (£17.31) and economics (£16.59). For both men and women, the lowest mean hourly earnings are attributable to those with an arts degree (£13.81 for men, £12.15 for women), followed by mass communications.

Whilst the focus of most papers considering the returns to a degree focus on first degrees, I also examine the returns to higher degrees, focusing on masters and PhDs. Table 5.5 presents mean hourly earnings by twenty subject areas for those with masters degrees. As with first degrees, those whose masters degree is in the subject area of medicine and dentistry earn the most (£25.45 for men and £23.87 for women). This is followed by business administration, for men (£22.29) and law for women (£21.43). Economics follows for men (£21.70), but I find that female masters degree earnings in economics are low in comparison (£15.87).

Table 5.6 presents the difference between first degree and masters degree earnings. Subject areas have been ranked (R) according to the percentage difference between first degree and masters degree earnings. From table 5.6, negative returns for obtaining a masters degree in comparison to a first degree are found in several subjects. It is worth noting that no controls are included at this point. Negative returns for obtaining a masters degree are found for men in the politics subject area, physical sciences and language and literature, whilst a fall in earnings at masters level is also found for women who studied physical sciences, economics, politics and language and literature. The largest percentage gain for obtaining a masters degree relative to a first degree is found in business administration (21.94% for men and 26.09% for women). When focusing on first degrees, arts offers the lowest average hourly earnings for both men and women, and earnings at masters degree level for arts still rank lowly (20th for men and 16th for women). However, due to the low earnings at first degree level, the percentage increase at masters degree level is large, especially for women (21.15%, which is the fourth largest percentage gain for women).

Table 5.5

Mean Hourly Earnings by Masters Subject Area

	Male			Female		
	Hourly	**R.**	**N.**	**Hourly**	**R.**	**N.**
Medicine & Dentistry	25.45	1	36	23.87	1	31
Medicine Related	18.32	10	103	17.54	6	247
Biological Sciences	16.84	15	130	16.34	7	219
Veterinary & Agricultural	18.70	8	49	15.27	12	37
Physical Sciences	17.30	13	240	14.80	15	123
Maths & Computing Science	19.39	7	406	16.25	8	141
Engineering	19.99	5	451	17.69	5	63
Technologies	19.84	6	36	13.50	20	20
Architecture	18.34	9	124	15.65	11	51
Economics	21.70	3	95	15.87	9	43
Politics	15.44	18	55	14.07	19	47
Social Studies	17.90	12	151	15.78	10	311
Law	20.78	4	127	21.43	2	78
Business Administration	22.29	2	779	18.46	3	406
Mass Communications	15.44	18	80	14.99	14	106
Linguistics & Classics	16.90	14	61	15.27	12	131
Language & Literature	16.17	17	37	14.43	17	64
History & Philosophy	16.31	16	164	14.43	17	144
Arts	15.43	20	116	14.72	16	109
Education	18.04	11	151	17.80	4	245

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to masters degree level in each subject area; R. is the rank of subject areas in order of mean hourly earnings.

Table 5.6

Comparison of Mean Hourly Earnings at First Degree and Masters Level by Subject Area

	Males					Females				
	First	Mast	Diff.	%	R.	First	Mast.	Diff.	%	R.
Medicine & Dentistry	22.83	25.4	2.62	11.48	6	19.7	23.87	4.11	20.8	5
Medicine Related	16.00	18.3	2.32	14.50	4	14.4	17.54	3.07	21.2	3
Biological Sciences	15.44	16.8	1.40	9.07	8	13.7	16.34	2.55	18.4	6
Veterinary & Agricultural	15.69	18.7	3.01	19.18	3	12.8	15.27	2.38	18.4	7
Physical Sciences	17.90	17.3	-0.60	-3.35	19	14.9	14.80	-0.15	-1.00	18
Maths & Computing Sci.	18.74	19.3	0.65	3.47	15	16.1	16.25	0.11	0.68	16
Engineering	18.91	19.9	1.08	5.71	13	16.5	17.69	1.19	7.21	11
Technologies	16.56	19.8	3.28	19.81	2	12.7	13.50	0.75	5.88	12
Architecture	18.03	18.3	0.31	1.72	17	15.2	15.65	0.42	2.76	15
Economics	20.94	21.7	0.76	3.63	14	16.5	15.87	-0.72	-4.34	20
Politics	18.23	15.4	-2.79	-15.30	20	14.3	14.07	-0.31	-2.16	19
Social Studies	16.44	17.9	1.46	8.88	9	13.7	15.78	2.08	15.1	10
Law	20.25	20.7	0.53	2.62	16	17.3	21.43	4.12	23.8	2
Business Administration	18.28	22.2	4.01	21.94	1	14.6	18.46	3.82	26.0	1
Mass Communications	13.85	15.4	1.59	11.48	6	12.7	14.99	2.27	17.8	8
Linguistics & Classics	15.56	16.9	1.34	8.61	10	14.5	15.27	0.75	5.17	13
Language & Literature	16.27	16.1	-0.10	-0.61	18	14.5	14.43	-0.12	-0.82	17
History & Philosophy	15.03	16.3	1.28	8.52	11	13.9	14.43	0.51	3.66	14
Arts	13.81	15.4	1.62	11.73	5	12.1	14.72	2.57	21.1	4
Education	16.92	18.0	1.12	6.62	12	15.3	17.80	2.49	16.2	9

Notes: diff. is the difference between mean hourly earnings at first degree and masters level; % is the percentage difference between first degree and masters; R. is the rank of subjects in order of percentage change

At PhD level (table 5.7), some subject areas suffer from very small sample sizes, so any figures may be affected by this. Medicine and dentistry again dominates the male rankings (with earnings exceeding £27 per hour). For women, the hourly earnings of PhD holders in mass communications and education exceed those in medicine and dentistry by £0.86 and £0.52 per hour. Men in economics perform very strong at PhD level, earning £24.18 per hour.

A decrease of £1.12 per hour between masters and PhD for women in the medicine and dentistry subject area helps to explain its displacement from the top of the earnings rankings, although, men in medicine and dentistry experience gains from possession of a PhD, at 7.19% (table 5.8). The largest increase for women between masters and PhD level is found in mass communications, at 57.51%, but this result is found from a small sample at PhD level. Outside of mass communications, the largest female increase is found in medicine related subjects. Large percentage gains for men are found in the politics (33.42%) subject area, although this figure is influenced by low earnings at masters level. Negative returns are found for men with PhDs in technologies, linguistics and classics, and mass communications, and for women in business administration, economics, law, medicine and dentistry, politics, and language and literature.

For the purposes of this chapter the UK is divided into twelve regions, corresponding to NUTS1 definitions. Table 5.9 gives mean hourly earnings at first degree level for these twelve regions:[48] The South Eastern regions of the UK display greater mean hourly earnings than Northern areas, particularly London, which has hourly earnings of £20.63 for men and £17.07 for women. London is followed by the South East and the East of England. At the lower end of the regional earnings rankings are Northern Ireland, Wales and the North East of England.

[48] Mean earnings figures have been compared to figures taken from the Annual Survey of Hours and Earnings (ASHE). Figures are broadly similar, although APS means are lower, which would be expected according to Ada *et al.* (2006).

Table 5.7

Mean Hourly Earnings by PhD Subject Area

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
Medicine & Dentistry	27.28	1	75	22.75	3	55
Medicine Related	23.21	4	72	19.33	6	64
Biological Sciences	19.71	11	219	17.52	9	214
Veterinary & Agricultural	19.13	13	17	17.14	10	15
Physical Sciences	20.67	8	346	17.01	11	92
Maths & Computing	20.23	10	103	20.00	4	22
Engineering	21.71	6	133	18.79	8	20
Technologies	16.36	18	22	14.66	15	5
Architecture	21.08	7	4	16.57	13	4
Economics	24.18	2	26	13.40	19	6
Politics	20.60	9	11	13.82	18	4
Social Studies	18.49	14	40	18.82	7	32
Law	22.24	5	10	19.65	5	8
Business Administration	23.30	3	24	13.28	20	15
Mass Communications	15.38	20	3	23.61	1	4
Linguistics & Classics	15.42	19	25	16.93	12	26
Language & Literature	16.86	17	12	14.36	17	12
History & Philosophy	18.30	15	57	14.43	16	30
Arts	17.37	16	16	16.39	14	8
Education	19.43	12	24	23.27	2	17

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to PhD level in each subject area; R. is the rank of subject areas in order of mean hourly earnings.

Table 5.8

Comparison of Mean Hourly Earnings at Masters and PhD Level by Subject Areas

	Males					Females				
	Mast	PhD	Diff.	%	R.	Mast	PhD	Diff.	%	R.
Medicine & Dentistry	25.4	27.28	1.83	7.19	11	23.8	22.75	-1.12	-4.69	17
Medicine Related	18.3	23.21	4.89	26.69	2	17.5	19.33	1.79	10.21	9
Biological Sciences	16.8	19.71	2.87	17.04	4	16.3	17.52	1.18	7.22	11
Veterinary & Agricultural	18.7	19.13	0.43	2.30	17	15.2	17.14	1.87	12.25	6
Physical Sciences	17.3	20.67	3.37	19.48	3	14.8	17.01	2.21	14.93	5
Maths & Computing Sci.	19.3	20.23	0.84	4.33	14	16.2	20.00	3.75	23.08	3
Engineering	19.9	21.71	1.72	8.60	9	17.6	18.79	1.10	6.22	12
Technologies	19.8	16.36	-3.48	-17.54	20	13.5	14.66	1.16	8.59	10
Architecture	18.3	21.08	2.74	14.94	5	15.6	16.57	0.92	5.88	13
Economics	21.7	24.18	2.48	11.43	8	15.8	13.40	-2.47	-15.56	19
Politics	15.4	20.60	5.16	33.42	1	14.0	13.82	-0.25	-1.78	16
Social Studies	17.9	18.49	0.59	3.30	16	15.7	18.82	3.04	19.26	4
Law	20.7	22.24	1.46	7.03	12	21.4	19.65	-1.78	-8.31	18
Business Administration	22.2	23.30	1.01	4.53	13	18.4	13.28	-5.18	-28.06	20
Mass Communications	15.4	15.38	-0.06	-0.39	18	14.9	23.61	8.62	57.51	1
Linguistics & Classics	16.9	15.42	-1.48	-8.76	19	15.2	16.93	1.66	10.87	8
Language & Literature	16.1	16.86	0.69	4.27	15	14.4	14.36	-0.07	-0.49	15
History & Philosophy	16.3	18.30	1.99	12.20	7	14.4	14.43	0.00	0.00	14
Arts	15.4	17.37	1.94	12.57	6	14.7	16.39	1.67	11.35	7
Education	18.0	19.43	1.39	7.71	10	17.8	23.27	5.47	30.73	2

Notes: diff. is the difference between mean hourly earnings at masters and PhD level; % is the percentage difference between masters and PhD; R. is the rank of subjects in order of percentage change

Table 5.9

Mean Hourly Earnings for First Degree by Region

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
East	17.31	3	750	14.00	3	829
East Midlands	16.64	5	746	13.68	6	735
London	20.63	1	2,182	17.07	1	2,001
North East	15.50	10	687	13.07	10	794
North West	16.08	7	1,470	13.51	8	1,550
Northern Ireland	15.20	11	235	12.69	12	322
Scotland	16.93	4	1,759	13.94	4	2,070
South East	18.52	2	1,954	14.86	2	1,892
South West	16.13	6	1,078	13.35	9	1,099
Wales	15.15	12	1,009	12.77	11	1,184
West Midlands	16.06	8	974	13.80	5	978
Yorkshire	15.82	9	1,006	13.67	7	1,033

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to first degree level working in each region; R. is the rank of regions in order of mean hourly earnings.

Table 5.10

Mean Hourly Earnings for Masters by Region

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
East	18.53	4	229	16.71	3	171
East Midlands	18.20	6	156	14.78	10	127
London	21.87	1	821	18.53	1	593
North East	17.89	10	174	16.59	4	153
North West	18.48	5	334	14.93	9	274
Northern Ireland	17.05	12	70	14.57	11	74
Scotland	17.97	7	489	15.42	12	426
South East	18.89	3	592	16.84	2	437
South West	19.02	2	309	15.71	8	217
Wales	17.92	9	286	15.81	6	286
West Midlands	17.82	11	273	15.79	7	210
Yorkshire	17.93	8	252	16.05	5	208

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to masters degree level working in each region; R. is the rank of regions in order of mean hourly earnings.

Table 5.10 shows that, at masters degree level, London again offers higher earnings than other regions for both men and women (£21.87 and £18.53). For men, the South West offers the second highest earnings, followed by the South East and the East of England, with Northern Ireland offering the lowest earnings. This result is similar to that of first degree hourly earnings. Results for women at masters degree level display significant differences from those at first degree level outside of the South Eastern regions.

Table 5.11 presents the difference between first degree hourly earnings and masters degree hourly earnings for men and women by region. Regions are ranked in order of the percentage difference between first degree hourly earnings and masters degree hourly earnings. London, which offers the highest hourly earnings for both men and women at first degree level and masters degree level, has relatively small percentage gains for obtaining a masters degree relative to a first degree at 6.01% for men and 8.55% for women. The only smaller percentage difference is found for males in the South East at 2%. Hourly earnings for women show significant differences between first degree and masters level. At first degree level, for women, the North East offers the 10th highest hourly earnings (only Northern Ireland and Wales offer lower hourly earnings). However, at masters degree level, the North East offers the fourth highest hourly earnings, a 26.93% jump, from £13.07 to £16.59. Wales, which offered the second lowest hourly earnings at first degree level (£12.77), offers far higher hourly earnings at masters degree level (£15.81%), resulting in a percentage difference of 23.81%. The percentage difference for gaining a masters degree relative to a first degree is greater for women (14.63%) than men (10.17%), suggesting women benefit more than men from continuing their education to masters degree level. Regarding masters degree gains for men, the largest percentage gains are found in Wales (18.28%), followed by the South West (17.92%) and the North East (15.42%). It appears from these raw statistics that there is more to be gained from obtaining a masters degree relative to a first degree in the regions that tend to be characterised by lower earnings in general.

Table 5.11

Comparison of Mean Hourly Earnings at First Degree and Masters Level by Region

	Males					Females				
	First	Mast.	Diff.	%	R.	First	Mast.	Diff.	%	R.
East	17.31	18.53	1.22	7.05	9	14.00	16.71	2.71	19.36	3
East Midlands	16.64	18.20	1.56	9.37	8	13.68	14.78	1.10	8.04	12
London	20.63	21.87	1.24	6.01	11	17.07	18.53	1.46	8.55	11
North East	15.50	17.89	2.39	15.42	3	13.07	16.59	3.52	26.93	1
North West	16.08	18.48	2.40	14.93	4	13.51	14.93	1.42	10.51	10
Northern Ireland	15.20	17.05	1.85	12.17	6	12.69	14.57	1.88	14.81	6
Scotland	16.93	17.97	1.04	6.14	10	13.94	15.42	1.48	10.62	9
South East	18.52	18.89	0.37	2.00	12	14.86	16.84	1.98	13.32	8
South West	16.13	19.02	2.89	17.92	2	13.35	15.71	2.36	17.68	4
Wales	15.15	17.92	2.77	18.28	1	12.77	15.81	3.04	23.81	2
West Midlands	16.06	17.82	1.76	10.96	7	13.80	15.79	1.99	14.42	7
Yorkshire	15.82	17.93	2.11	13.34	5	13.67	16.05	2.38	17.41	5

Notes: diff. is the difference between mean hourly earnings at first degree and masters level; % is the percentage difference between first degree and masters; R. is the rank of regions in order of percentage change

Table 5.12 reveals that, at PhD level, London continues to dominate, for both men and women. PhD earnings are also high for both men and women in the South East. The West Midlands perform very strong, especially for women. Once again, Northern Ireland sits at the foot of the earnings rankings, for both genders.

The differences between masters and PhD earnings are shown in table 5.13. There are two instances of earnings falling between masters and PhD level: for men in Northern Ireland and women in the East of England (both these falls are fairly small: 7.92% and 4.13%). No controls are included in the calculation of these raw statistics, so these falls may be caused by characteristics differences. The largest increases for men are found in the West Midlands, South East and Wales, and for women in the East Midlands, North West and West Midlands. Growth in London is small, at around 3-6%; although this is offset by high masters earnings.

I also intend to look at the returns to education by industry sectors. The sample is split into nine industry sectors. Table 5.14 gives mean hourly earnings at first degree level by the industry sector that the individual is employed in. At first degree level the highest hourly earnings are found in the energy and water; banking, finance and insurance; and manufacturing industries. The lowest hourly earnings for both males and females are seen in the agriculture and fishing sector.

Table 5.15 gives mean hourly earnings for industry sectors for those educated to masters level. Table 5.16 gives the percentage difference between first degree level hourly earnings and masters degree level hourly earnings by industry sector. The highest hourly earnings at masters degree level are found in the banking, finance and insurance sector for men (£22.13) and the energy and water sector for women (£19.15). Table 5.16 reveals that the largest percentage increase from gaining a masters degree relative to a first degree for men is found in the agriculture and fishing sector (69.52%). This effect is magnified by the agriculture and fishing sector's particularly low mean hourly earnings at first degree level and the small number of observations at masters level. At first degree level, mean hourly earnings

Table 5.12

Mean Hourly Earnings for PhD by Region

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
East	20.08	7	112	16.02	11	48
East Midlands	20.21	5	75	18.07	5	40
London	22.57	1	176	19.59	1	102
North East	19.63	11	59	17.09	9	44
North West	19.69	10	141	17.65	7	77
Northern Ireland	15.70	12	22	15.14	12	13
Scotland	19.94	9	174	17.52	8	105
South East	21.42	2	234	18.23	3	106
South West	21.07	3	100	18.13	4	57
Wales	20.12	6	115	16.35	10	50
West Midlands	20.47	4	79	18.56	2	34
Yorkshire	20.05	8	96	17.82	6	56

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to PhD level working in each region; R. is the rank of regions in order of mean hourly earnings.

Table 5.13

Comparison of Mean Hourly Earnings at Masters and PhD Level by Region

	Males					Females				
	Mast.	**PhD**	**Diff.**	**%**	**R.**	**Mast.**	**PhD**	**Diff.**	**%**	**R.**
East	18.53	20.08	1.55	8.36	9	16.71	16.02	-0.69	-4.13	12
East Midlands	18.20	20.21	2.01	11.04	5	14.78	18.07	3.29	22.26	1
London	21.87	22.57	0.70	3.20	11	18.53	19.59	1.06	5.72	8
North East	17.89	19.63	1.74	9.73	8	16.59	17.09	0.50	3.01	11
North West	18.48	19.69	1.21	6.55	10	14.93	17.65	2.72	18.22	2
Northern Ireland	17.05	15.70	-1.35	-7.92	12	14.57	15.14	0.57	3.91	9
Scotland	17.97	19.94	1.97	10.96	6	15.42	17.52	2.10	13.62	5
South East	18.89	21.42	2.53	13.39	2	16.84	18.23	1.39	8.25	7
South West	19.02	21.07	2.05	10.78	7	15.71	18.13	2.42	15.40	4
Wales	17.92	20.12	2.20	12.28	3	15.81	16.35	0.54	3.42	10
West Midlands	17.82	20.47	2.65	14.87	1	15.79	18.56	2.77	17.54	3
Yorkshire	17.93	20.05	2.12	11.82	4	16.05	17.82	1.77	11.03	6

Notes: diff. is the difference between mean hourly earnings at masters and PhD level; % is the percentage difference between masters and PhD; R. is the rank of regions in order of percentage change

Table 5.14

Mean Hourly Earnings for First Degree by Industry Sector

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
Agriculture & Fishing	10.40	9	45	11.53	9	38
Energy & Water	20.49	1	321	15.84	3	106
Manufacturing	18.42	3	2,321	16.05	2	977
Construction	17.56	5	668	13.81	6	157
Distribution, Hotels & Rest.	14.17	7	1,014	11.77	8	952
Transport & Communication	17.76	4	712	15.03	4	350
Banking, Finance & Insurance	20.17	2	3,801	16.45	1	2,388
Public Admin, Educ. & Health	15.92	6	4,330	14.09	5	8,853
Other Services	13.86	8	683	13.26	7	666

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to first degree level working in each industry sector; R. is the rank of regions in order of mean hourly earnings.

Table 5.15

Mean Hourly Earnings for Masters by Industry Sector

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
Agriculture & Fishing	17.63	7	13	13.39	7	12
Energy & Water	21.19	2	91	19.15	1	23
Manufacturing	19.86	4	554	18.92	3	191
Construction	19.03	5	121	16.86	5	36
Distribution, Hotels & Rest.	16.46	8	194	11.06	9	117
Transport & Communication	20.57	3	176	19.00	2	63
Banking, Finance & Insurance	22.13	1	1,010	18.57	4	458
Public Admin, Educ. & Health	17.85	6	1,622	16.43	6	2,110
Other Services	16.46	8	220	13.37	8	170

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to masters degree level working in each industry sector; R. is the rank of regions in order of mean hourly earnings.

Table 5.16

Comparison of Mean Hourly Earnings at First Degree and Masters Level by Industry Sector

	Males					Females				
	First	Mast.	Diff.	%	R.	First	Mast.	Diff.	%	R.
Agriculture & Fishing	10.40	17.63	7.23	69.52	1	11.53	13.39	1.86	16.13	6
Energy & Water	20.49	21.19	0.70	3.42	9	15.84	19.15	3.31	20.90	3
Manufacturing	18.42	19.86	1.44	7.82	8	16.05	18.92	2.87	17.88	4
Construction	17.56	19.03	1.47	8.37	7	13.81	16.86	3.05	22.09	2
Distribution, Hotels & Rest.	14.17	16.46	2.29	16.16	3	11.77	11.06	-0.71	-6.03	9
Transport & Comms.	17.76	20.57	2.81	15.82	4	15.03	19.00	3.97	26.41	1
Banking, Finance & Ins.	20.17	22.13	1.96	9.72	6	16.45	18.57	2.12	12.89	7
Pub Admin, Educ. & Health	15.92	17.85	1.93	12.12	5	14.09	16.43	2.34	16.61	5
Other Services	13.86	16.46	2.60	18.76	2	13.26	13.37	0.11	0.83	8

Notes: diff. is the difference between mean hourly earnings at first degree and masters level; % is the percentage difference between first degree and masters; R. is the rank of industries in order of percentage change are ranked fourth for the transport and communications sector, but this sector is ranked third at masters degree level for men (£20.07) and second for women (£19.00), resulting in the fourth largest percentage gains (15.82%) for men and the largest gains (26.41%) for women. The energy and water sector, which was ranked first for men and second for women at first degree level offers a very small percentage increase in mean hourly earnings between first degree and higher degree level for men (3.42%), but a large increase for women (20.90%). Wage differences between first degree and masters degree level are positive for all industry sectors, except for women in the distribution, hotels and restaurants sector, who experience a fall of 6.03%. At PhD level, results are affected by a very uneven distribution of observations, with the majority of PhD holders employed in the public administration, education and health sector. For this reason, I do not comment on the mean earnings

The majority of this research has been carried out at the regional level, corresponding to NUTS1 classification. I have taken Wales to use as a case study for a sub-regional analysis, extending the research to unitary authority level, according to where individuals work. This will allow me to see how changes in the returns to education vary at a sub-regional level. Table 5.A2 in the appendix gives summary statistics for the Welsh sample. Table 5.17 breaks down Welsh hourly earnings at first degree level across all twenty-two Welsh unitary authorities. Unitary authorities are ranked according to mean hourly earnings for ease of analysis.

For men, hourly earnings are greatest in Blaenau Gwent for men and the Vale of Glamorgan for women. There is much variation between male and female hourly earnings at unitary authority level. In Conwy, Anglesey and Powys, female hourly earnings exceed male hourly earnings, a result which is influenced by the low male earnings in these unitary authorities (Conwy is ranked last for male earnings). The lowest hourly earnings for women are found in Monmouthshire.

Table 5.17

Mean Hourly Earnings for First Degree by Unitary Authority (Wales Only)

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
Blaenau Gwent	18.65	1	14	12.48	13	10
Bridgend	14.67	13	49	11.93	18	61
Caerphilly	17.00	3	41	13.14	8	46
Cardiff	14.91	11	206	12.78	10	214
Carmarthenshire	13.93	15	39	11.66	20	42
Ceredigion	13.93	15	39	11.55	21	61
Conwy	12.49	22	17	13.35	7	34
Denbighshire	16.04	7	38	13.57	5	44
Flintshire	16.65	5	41	12.60	12	35
Gwynedd	12.72	21	45	12.35	14	71
Isle of Anglesey	13.25	20	18	13.42	6	20
Merthyr Tydfil	13.84	17	17	12.67	11	23
Monmouthshire	14.74	12	33	11.20	22	40
Neath Port Talbot	15.97	8	29	14.29	2	35
Newport	16.82	4	86	12.21	16	64
Pembrokeshire	15.00	10	39	11.68	19	38
Powys	13.71	18	36	13.91	3	43
RCT	15.16	9	34	13.88	4	78
Swansea	13.59	19	83	12.29	15	104
Torfaen	13.98	14	35	13.09	9	42
Vale of Glamorgan	16.33	6	31	14.63	1	44
Wrexham	18.10	2	39	12.09	17	35

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to first degree level working in each Welsh unitary authority; R. is the rank of unitary authorities in order of mean hourly earnings.

Table 5.18 gives average hourly earnings at masters degree level for Welsh unitary authorities. Table 5.19 details the differences between first degree mean hourly earnings and masters degree mean hourly earnings, ranked by percentage difference. Masters degree earnings for men peak at £30.16 an hour in the Vale of Glamorgan, closely followed by the Wrexham (£28.39). The largest female hourly earnings at masters level are found in Flintshire (£20.41), followed by Torfaen (£20.13). The lowest masters degree hourly earnings are found in Anglesey, Conwy and Ceredigion. Turning to table 5.19, masters degree hourly earnings exceed first degree hourly earnings in all cases except for males in Denbighshire, and women in Anglesey and Powys. The largest masters degree gains relative to first degree for men are found in the Vale of Glamorgan and Wrexham. The large masters degree gains of Merthyr Tydfil (42.23%) are being driven by Merthyr's position at the foot of the first degree hourly earnings rankings. Flintshire boasts the greatest percentage gains for women, at 61.95%, which reflects Flintshire's large masters degree female earnings, which are greater than corresponding earnings for men. The next highest percentage gains for females are found in Blaenau Gwent and Wrexham.

Specification

So far, I have presented an analysis of mean earnings at varying degree levels across regions, subject areas and industries, but I have not included any controls for respondents' personal characteristics, occupation and other personal characteristics. To gauge the effect of higher education on earnings, amongst other returns on education, I use an augmented Mincer (1974) earnings function with the following specification:

$$\ln E_i = a + \lambda FIRSTDEG\_ALEVEL_i + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha YEAR_t + \varepsilon_{irt} \qquad (1)$$

The dependent variable is the logarithm of hourly earnings (E). A dummy variable is not required to control for gender, as regressions are gender specific. Controls for personal characteristics (X) include age and its square, job tenure, a dummy variable

Table 5.18

Mean Hourly Earnings for Masters by Unitary Authority (Wales Only)

	Male			Female		
	Hourly Earnings	R.	N.	Hourly Earnings	R.	N.
Blaenau Gwent	19.60	6	3	19.77	3	4
Bridgend	17.54	11	15	14.26	17	10
Caerphilly	21.65	4	10	17.58	6	5
Cardiff	16.73	13	65	15.34	12	69
Carmarthenshire	15.29	17	13	13.29	18	13
Ceredigion	14.56	20	12	12.96	19	12
Conwy	14.10	22	9	14.33	16	9
Denbighshire	14.94	18	6	18.27	5	13
Flintshire	17.83	10	8	20.41	1	10
Gwynedd	14.72	19	17	14.43	15	23
Isle of Anglesey	14.47	21	6	7.95	22	2
Merthyr Tydfil	19.68	5	2	14.87	13	4
Monmouthshire	16.33	14	11	12.33	21	15
Neath Port Talbot	22.03	3	7	17.54	7	14
Newport	16.89	12	20	14.44	14	10
Pembrokeshire	15.34	16	10	16.58	10	5
Powys	19.25	9	9	12.41	20	10
RCT	19.29	8	18	16.03	11	8
Swansea	15.35	15	24	17.40	9	26
Torfaen	19.40	7	7	20.13	2	7
Vale of Glamorgan	30.16	1	6	17.46	8	8
Wrexham	28.39	2	8	18.98	4	9

Notes: mean hourly earnings expressed in £s; N. is the number of individuals qualified to masters degree level working in each Welsh unitary authority; R. is the rank of unitary authorities in order of mean hourly earnings.

Table 5.19

Comparison of Mean Hourly Earnings at First Degree and Masters Level by Unitary Authority (Wales Only)

	Males					Females				
	First	**Mast.**	**Diff.**	**%**	**R.**	**First**	**Mast.**	**Diff.**	**%**	**R.**
Blaenau Gwent	18.65	19.60	0.95	5.09	18	12.48	19.77	7.29	58.36	2
Bridgend	14.67	17.54	2.87	19.57	9	11.93	14.26	2.34	19.59	11
Caerphilly	17.00	21.65	4.65	27.32	7	13.14	17.58	4.44	33.74	8
Cardiff	14.91	16.73	1.82	12.18	13	12.78	15.34	2.55	19.95	10
Carmarthenshire	13.93	15.29	1.36	9.77	15	11.66	13.29	1.62	13.90	17
Ceredigion	13.93	14.56	0.63	4.54	19	11.55	12.96	1.41	12.20	18
Conwy	12.49	14.10	1.61	12.89	12	13.35	14.33	0.97	7.30	20
Denbighshire	16.04	14.94	-1.09	-6.82	22	13.57	18.27	4.71	34.71	7
Flintshire	16.65	17.83	1.18	7.07	17	12.60	20.41	7.81	61.95	1
Gwynedd	12.72	14.72	2.00	15.69	10	12.35	14.43	2.08	16.85	15
Isle of Anglesey	13.25	14.47	1.22	9.21	16	13.42	7.95	-5.48	-40.79	22
Merthyr Tydfil	13.84	19.68	5.84	42.23	3	12.67	14.87	2.19	17.31	14
Monmouthshire	14.74	16.33	1.59	10.76	14	11.20	12.33	1.13	10.09	19
Neath Port Talbot	15.97	22.03	6.06	37.98	6	14.29	17.54	3.25	22.73	9
Newport	16.82	16.89	0.08	0.45	21	12.21	14.44	2.23	18.30	13
Pembrokeshire	15.00	15.34	0.34	2.26	20	11.68	16.58	4.90	41.91	5
Powys	13.71	19.25	5.54	40.43	4	13.91	12.41	-1.51	-10.83	21
RCT	15.16	19.29	4.13	27.24	8	13.88	16.03	2.15	15.50	16
Swansea	13.59	15.35	1.76	12.96	11	12.29	17.40	5.11	41.55	6
Torfaen	13.98	19.40	5.42	38.79	5	13.09	20.13	7.04	53.77	4
Vale of Glamorgan	16.33	30.16	13.83	84.69	1	14.63	17.46	2.83	19.36	12
Wrexham	18.10	28.39	10.29	56.81	2	12.09	18.98	6.90	57.07	3

Notes: diff. is the difference between mean hourly earnings at first degree and masters level; % is the percentage difference between first degree and masters; R. is the rank of unitary authorities in order of percentage change indicating whether an individual is married, a dummy variable indicating whether an individual suffers from a health issue that is activity limiting, a dummy variable indicating whether an individual is employed in the public sector and a dummy variable that indicates whether an individual is in part time employment. Vectors of dummy variables are included, which indicate an individual's ethnicity (6 categories) and employer size (4 categories). Controls for industrial sector (IND) and occupational group (OCC) are included as vectors of dummy variables (with the importance of occupation in controlling for earnings variation demonstrated in the previous chapter). I also control for the year the observation is taken from (YEAR).

The dummy variable representing highest qualification level is the key variable in the model, giving a measure of the effect of education on hourly earnings.[49] Taking the effect of a first degree on hourly earnings relative to A levels as an example; the sample is restricted to those who are educated to either A level or first degree level, and a dummy variable (FIRSTDEG_ALEVEL) is inserted taking a value of 1 if an individual is educated to first degree level and 0 if they are not (therefore they would be educated to A level). The coefficient (λ) will then give the effect of a first degree (highest education level in sample) on hourly earnings relative to A level (baseline education level in sample) all else held constant. The majority of results in the results section are based on a model measuring the effect on hourly earnings of first degree relative to a baseline of A level holders, but there are some exceptions, also measuring the premium paid to masters degrees relative to first degrees (2) and PhDs relative to masters degrees (3).

$$\ln E_i = a + \lambda MASTERS\_FIRSTDEG_i + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha YEAR_t + \varepsilon_{irt} \qquad (2)$$

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[49] As pointed out in Halvorsen and Palmquist (1980), due to the semi-logarithmic form of the estimation equation, the coefficient (α) does not give the percentage effect on earnings (δ). The percentage effect on earnings is given by $\delta = \exp(\alpha) - 1$. δ is greater than α, however, they are very close at small magnitudes. We report the coefficient (α).

$$\ln E_i = a + \lambda PHD\_MASTERS_i + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha YEAR_t + \varepsilon_{irt} \quad (3)$$

Additionally, I measure the returns of masters degrees relative to A levels (4) and also PhDs relative to A level (5). This is particularly useful for PhDs, as the difference in earnings between PhDs and masters degrees is often small. Using specifications (4) and (5) it is possible to compare the returns to masters and PhDs both relative to A levels.

$$\ln E_i = a + \lambda MASTERS\_ALEVEL_i + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha YEAR_t + \varepsilon_{irt} \quad (4)$$

$$\ln E_i = a + \lambda PHD\_ALEVEL_i + \beta X_i + \alpha IND_i + \alpha OCC_i + \alpha YEAR_t + \varepsilon_{irt} \quad (5)$$

Whilst these are the basic specifications used in this chapter, disaggregations of the sample are also used to measure the differences in returns to qualifications over different groups and also over the earnings distribution.

5.4 Results

Table 5.20 presents results from a regression of a first degree dummy variable and a full set of controls on the log of hourly earnings. This corresponds to specification (1), which restricts the sample to those whose highest qualifications are A levels or first degrees. The coefficient on the first degree dummy suggests a return of .20651 for men and .21652 for women to holding a first degree relative to A levels. These returns are highly significant. Most control variables behave as would be expected. Negative returns are found to marriage and to working in the public sector (for men only). All ethnicities, except for Chinese, display a mark-up relative to the omitted group (the 'other' category) for men, but results are insignificant for women. The

Table 5.20

Full Regression Results for Returns to First Degree

	Male		**Female**	
	Coeff.	**t stat**	**Coeff.**	**t stat**
First Degree	.20651***	42.90	.21652***	43.23
Age	.05406***	34.52	.03873***	21.71
Age^2	-.0006***	33.61	-.00045***	21.15
Part Time	-.10245***	10.53	-.04758***	10.24
Public	-.0292***	4.07	.01949***	3.13
Job Tenure	.00609***	27.25	.00957***	30.68
Health Limit	-.06955***	10.54	-.03301***	4.64
Married	-.06394***	13.60	-.01081**	2.32
Plant Size				
25 to 49	.10424***	16.75	.05424***	8.38
50 to 499	.14737***	30.82	.09756***	18.42
500 and over	.22107***	38.35	.14636***	23.53
Ethnicity				
White	.1342***	5.37	.01647	0.64
Mixed	.1039***	2.60	.04231	1.16
Asian	.06656**	2.39	.00277	0.10
Black	.07727**	2.50	.03026	0.99
Chinese	.01192	0.26	.01004	0.22
Industry				
Agriculture & Fishing	-.29626***	12.63	-.13277***	3.93
Energy & Water	-.01588	1.24	-.04521*	1.89
Manufacturing	-.13421***	21.11	-.06838***	7.21
Construction	-.07179***	9.26	-.0926***	5.35
Distribution, Hotels & Rest.	-.24932***	33.89	-.25659***	30.39
Transport & Comms.	-.10488***	12.78	-.05188***	4.26
Public Administration	-.16663***	19.89	-.16657***	21.97
Other Services	-.23586***	21.90	-.1755***	16.74
Occupation				
Managerial	.41916***	44.92	.3775***	51.94
Professional	.34206***	35.54	.40012***	54.16
Associate Pro. & Technical	.23386***	24.80	.21117***	31.78
Skilled Trade	.05538***	5.72	-.13567***	7.00
Personal Service	-.11713***	7.83	-.12166***	15.92
Sales	-.09028***	6.06	-.13308***	13.06
Process, Plant & Machinery	-.08655***	8.08	-.20939***	9.35
Elementary	-.22302***	19.33	-.24975***	21.28
Year				
2005	.04149***	8.10	.04711***	8.23

2006	.07638***	14.69	.07023***	12.49
2007	.11018***	21.26	.11196***	20.11
Constant	.88824***	21.01	1.22808***	27.64

Notes: regression results from specification (1); significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

high earnings of the banking, finance and insurance sector can be seen when it is used as the omitted industry, with all other industries displaying negative coefficients. Relative to the control group of administrative and secretarial occupations, managerial, professional, and associate professional and technical occupations have positive returns. For men, returns to skilled trades are also positive. The coefficients on year dummies are increasing with time, suggesting earnings have risen over the sample period (as shown in the data section).

Whilst the primary focus of my research is on the returns to a first degree relative to A levels, masters degree relative to a first degree, and PhD relative to masters, table 5.21 presents a breakdown of the returns to each level of qualifications relative to every lower qualification level. For example, the returns to a PhD are measured relative to masters, PGCE, first degree, higher education, A level, GCSE and no qualifications. The upper right hand section of table 5.21 contains results for men, whilst results for women are in the lower left hand section. For men, baseline qualifications are found on the horizontal, whilst for women they are on the vertical.

Table 5.21

Regression Results by Qualification Level

	PhD	Masters	PGCE	First Degree	Higher Education	A-Level	GCSE	None
PhD		.02006	.07358***	.08444***	.2542***	.32684***	.34115***	.5524***
		(1.45)	(4.04)	(6.93)	(20.51)	(27.40)	(24.07)	(29.92)
Masters	.01158		.04182***	.06713*** a	.23086*** b	.29311***	.32556***	.47129***
	(0.72)		(2.80)	(8.92)	(28.95)	(39.84)	(38.28)	(39.19)
PGCE	.13382***	.08343***		.01531	.15601***	.23403***	.23102***	.39786***
	(7.44)	(7.36)		(1.17)	(11.77)	(17.98)	(14.90)	(19.95)
First Degree	.07305***	.07905*** d	-.00756		.15317***	.20651***	.23528***	.34774***
	(4.88)	(10.36)	(0.84)		(27.77)	(42.90)	(41.66)	(39.63)
Higher Education	.21703***	.22798*** e	.08806***	.1272***		.06484***	.09673***	.23158***
	(15.38)	(30.17)	(9.52)	(26.99)		(14.59)	(19.09)	(33.76)
A-Level	.35992***	.34533***	.2525***	.21652***	.08836***		.03947*** c	.1414***
	(22.37)	(41.07)	(21.03)	(43.23)	(20.86)		(10.62)	(30.02)
GCSE	.45508***	.42158***	.33035***	.27952***	.14218***	.04969*** f		.11049***
	(29.64)	(53.12)	(28.30)	(59.33)	(36.54)	(15.42)		(21.68)
None	.5595***	.52084***	.35723***	.34092***	.20869***	.1158***	.07107***	
	(25.78)	(45.77)	(21.84)	(45.47)	(36.46)	(24.23)	(18.30)	

Notes: Separate regressions are carried out for each baseline qualification level; for example, the coefficient marked (a) measures the effect of a masters degree relative to first degree for men, (b) measures the effect of a masters degree relative to higher education for men and (c) measures the effect of A levels relative to GCSE for men. Correspondingly, for women, (d) measures the effect of a masters degree relative to first degree, (e) measures the effect of a masters degree relative to higher education and (f) measures the effect of A levels relative to GCSE; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

The results in table 5.21 are obtained from variations of the specifications in the previous section. As previously stated, the main focus is on the effects of first degree relative to A level. Those with A levels are considered the most appropriate baseline as it is likely that they would have been able to obtain a university place had they so desired, but they have chosen not to pursue this route. By measuring the effects of a first degree relative to A level, there should be many individuals of a similar ability level allowing the formulation of a good estimate of the pecuniary benefit of undertaking (and completing) a first degree.

For men, the returns to a first degree relative to A levels is .20651, whilst it is slightly larger for women, at .21652. This is consistent with the majority of existing literature, which finds that women benefit more than men from gaining a first degree (for example Blackaby, Murphy and O'Leary, 1999), although the difference between estimates is small. I also place high emphasis on the results of regressions measuring the premium paid to masters degree holders relative to those with a first degree. For men, I calculate a coefficient of .06713. For women, a slightly larger estimate of .07905 is found. This suggests that whilst women have more to gain from obtaining a first degree relative to A levels, this advantage extends to masters level, a result previously found by O'Leary and Sloane (2005). No significant effect is found for holding a PhD over a masters degree for either gender. This aggregated result may hide PhD premiums for smaller sub samples. This result is explored in greater depth throughout the chapter. All results appear as expected, with returns increasing with qualification level, with the exception of PGCE, which has no significant advantage over first degree level. The largest estimate is found for women with a PhD compared to no qualifications (.5595).

Class of First Degree

A recent addition to the APS is a question on the class of degree awarded at first degree level. Table 5.22 examines returns to class of degree relative to each lower class of degree. As with table 5.21, the upper right section presents coefficient

Table 5.22

Regression Results by Class of First Degree

	First	Upper Second	Lower Second	Third
First		.02105a	.06592***	.09777***
		(1.19)	(3.42)	(3.42)
Upper Second	-.02845*		.05268***	.08593***
	(1.68)		(3.80)	(3.42)
Lower Second	.01043	.03706***b		.03456
	(0.58)	(3.10)		(1.29)
Third	.04468	.07229**	.04449	
	(1.16)	(2.29)	(1.41)	

Notes: Separate regressions are carried out for each baseline qualification level; for example, the coefficient labelled (a) gives the return to a first class award relative to upper second for men and (b) gives the return to an upper second relative to a lower second for women; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.23

Returns to First Degree Relative to A Level by Class of First Degree

	Male			Female		
	Coeff.	**t stat**	**N.**	**Coeff.**	**t stat**	**N.**
First	.25093***	17.10	703	.24912***	16.80	683
Upper Second	.22681***	24.14	2,083	.26826***	29.72	2,589
Lower Second	.16954***	16.34	1,569	.22048***	21.46	1,679
Third	.13849***	6.50	304	.18568***	6.65	159

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree); baseline is A level; N. is the number of individuals qualified to each class of first degree; R. is the rank of unitary authorities in order of mean hourly earnings; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

estimates for men; results for women are in the lower left section. The baseline for men is on the horizontal, the baseline for women is on the vertical.[50]

For men, no significant earnings advantage is found to possessing a first class degree relative to an upper second class degree. This may be due to a large number of first class degree holders continuing on to gain higher degrees. In this case, they would not be counted amongst first class first degree holders. A similar result has been found by Walker and Zhu (2010). Earnings premiums are found for possessing a first class degree over those with lower second class degrees and third class degrees (this figure increases as the baseline declines for men). No significant effect is found for those with a lower second class degree relative to a third class degree.

Table 5.23 investigates the effects that the class of first degree awarded have on the graduate premium relative to A level qualifications. At all degree classes except first class, the premium relative to A level is greater for women than men, as found across the literature. Whilst it may be expected that the earnings premium will increase uniformly with degree class relative to A level, this is not the case. Women with an upper second class degree are found to have a greater earnings advantage relative to A level than those with a first class degree. For men, the largest returns relative to A level are found for those with a first class degree, as would be expected. The largest difference in graduate returns for men occurs between those with upper second class degrees and those with lower second class degrees (.22681 to .16954), a result in line with that found by Walker and Zhu (2010). Walker and Zhu report the there are 'consistently strong returns to a 2.1 vs a 2.2'.

Continuing the analysis of the effects of degree class on the graduate premium, table 5.24 presents the returns to a masters degree relative to a first degree, by the class of

[50] For example, the coefficient labelled (a) gives the return to a first class award relative to upper second for men and (b) gives the return to an upper second relative to a lower second for women.

Table 5.24

Returns to Masters Relative to First Degree by Class of First Degree

	Male		Female	
	Coeff.	**t stat**	**Coeff.**	**t stat**
First	.00909	0.48	.07538***	4.11
Upper Second	.02884**	2.12	.04282***	3.43
Lower Second	.08***	5.32	.08679***	6.25
Third	.10989***	4.16	.12809***	3.99

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (masters degree); baseline is first degree, disaggregated by degree class; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.25

Returns to First Degree Relative to A Level by NUTS 1 Region (National Baseline)

	Male				Female			
	Coeff.	**t stat**	**R.**	**N.**	**Coeff.**	**t stat**	**R.**	**N.**
East	.20644***	14.90	3	750	.22745***	17.42	3	829
East Midlands	.15211***	10.98	6	746	.19569***	14.16	7	735
London	.39963***	44.72	1	2,182	.42947***	45.79	1	2,001
North East	.12139***	8.39	11	687	.15996***	11.90	11	794
North West	.15444***	15.05	5	1,470	.19658***	19.38	9	1,550
Northern Ireland	.1319***	5.49	10	235	.16312***	8.18	10	322
Scotland	.18442***	19.33	4	1,759	.21917***	24.24	4	2,070
South East	.26072***	28.25	2	1,954	.25568***	26.82	2	1,892
South West	.14062***	11.98	9	1,078	.17725***	15.27	9	1,099
Wales	.09993***	8.24	12	1,009	.14713***	12.99	12	1,184
West Midlands	.14791***	11.99	7	974	.20869***	16.80	5	978
Yorkshire	.14415***	11.92	8	1,006	.18826***	15.75	8	1,033

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by region; national baseline of individuals qualified to A level; N. is the number of individuals qualified to first degree level in each region; R. is the rank of regions in order of magnitude of return to first degree; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

first degree. It would be expected that there would be less to gain from attaining a masters degree if an individual has a first degree with one of the higher first degree classes. Whilst table 5.24 does confirm that those possessing a lower class of first degree have more to gain from pursuing a masters degree than those with a first class or upper second class first degree, as observed in table 5.23, this effect does not uniformly decrease as the class of first degree rises in the case of women. For men I find no significant earnings advantage to possessing a masters degree over a first class first degree, although a small and significant effect is found compared to an upper second class first degree (.02884). A relatively large effect is found for women possessing a masters degree relative to a first class degree (.07538), which reinforces the result found in table 5.21 that women benefit more than men from obtaining a masters degree. This coefficient is larger than that found for upper second class first degrees (.04282). Results for both men and women confirm that those with a lower class of first degree have more to gain from obtaining a masters degree (although a lower class of first degree may obstruct an individual from gaining entry to a higher degree course, depending on the institution/course). As expected, the largest earnings advantage is found for those with a masters degree relative to a third class first degree (.10989 and .12809).

Region

A major focus of this chapter concerns how the graduate premium differs across regions (defined according to workplace). Table 5.25 presents results from a regression of those with a first degree (region specific) compared to a baseline of individuals with A levels from across the UK. This shows how graduates in a specific region fare compared to a national baseline of A level holders, and where mobile graduates will be able to enjoy the greatest earnings premiums.

Results reveal a large advantage in the earnings premium for the South Eastern regions, particularly London (.39963 for men and .42947 for women). This result is supported by the findings of O'Leary and Sloane (2008), where the premium in London is almost double that of any other region. As returns are measured against a national baseline of A level holders, much of this result can be attributed to the generally higher level of earnings in the South Eastern regions (this issue is explored in the following table). The largest graduate premium outside of the South Eastern regions is observed in Scotland. The earnings premium is greater for women than for men in all UK regions, with the exception of the South East. The smallest graduate premium is for Welsh men (.09993). Whilst the results of table 5.25 have implications for graduate migration, identifying where mobile graduate can enjoy the greatest graduate premiums, cost of living differences are not taken into account. Table 5.26 takes regional differences in earnings into account by comparing graduate earnings with a baseline of A level holders within the same region only. Results reveal that when measured against a regional baseline, the large advantage in the graduate premium experienced by the South Eastern regions is greatly diminished. For men, London now displays the smallest coefficient (.16449), a result that reflects the high earnings of A level holders in London. O'Leary and Sloane (2008) also find London to offer the smallest graduate premium when measured against its own A level holders. Of the South Eastern regions, only men in the South East of England maintain a (relatively) large graduate premium (.19732). In calculating the increase in earnings attributable to obtaining a first degree relative to A levels within regions, the variation in the graduate premium is greatly reduced (for men the graduate premium ranges from .16449 to .23458, and .15217 to .24146 for women). This shows that there is less incentive for graduate migration than table 5.25 would suggest, although given that there is still regional differences in the graduate premium, there is still some incentive for graduate migration. When focusing on just differences within regions, the largest graduate premiums for men are found in Northern Ireland and Scotland; and the East Midlands and the West Midlands for women. There are large differences within regions between genders. For example, a small female graduate premium is found in Northern Ireland, the site of the largest male premium, suggesting that women in Northern Ireland have significantly less to gain than men from obtaining a first degree (.23458 to .18336).

Whilst I have examined the returns to a first degree relative to A levels, table 5.27 looks at the gains attributable to obtaining a masters degree relative to a first degree, using a national baseline.

Table 5.26

Returns to First Degree Relative to A Level by NUTS 1 Region (Regional Baseline)

	Male				Female			
	Coeff.	t stat	R	N.	Coeff.	t stat	R.	N.
East	.16945***	8.26	11	750	.17566***	8.24	9	829
East Midlands	.21083***	10.33	3	746	.24146***	11.51	1	735
London	.16449***	11.37	12	2,182	.16352***	9.85	11	2,001
North East	.18969***	10.04	7	687	.19494***	10.27	6	794
North West	.20944***	15.07	4	1,470	.21924***	15.73	4	1,550
Northern Ireland	.23458***	6.82	1	235	.18336***	5.20	8	322
Scotland	.21492***	17.42	2	1,759	.21763***	18.46	5	2,070
South East	.19732***	14.57	5	1,954	.17409***	12.32	10	1,892
South West	.17551***	10.75	10	1,078	.1875***	10.56	7	1,099
Wales	.18062***	10.47	9	1,009	.15217***	9.23	12	1,184
West Midlands	.19231***	11.19	6	974	.23056***	12.23	2	978
Yorkshire	.18811***	11.76	8	1,006	.22782***	13.04	3	1,033

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by region; regional baseline of individuals qualified to A level; N. is the number of individuals qualified to first degree level in each region; R. is the rank of regions in order of magnitude of return to first degree; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.27

Returns to Masters Relative to First Degree by NUTS 1 Region (National Baseline)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
East	.00804	0.37	-	229	.08052***	3.62	6	171
East Midlands	.01581	0.66	-	156	.04415*	1.83	12	127
London	.19666***	14.05	1	821	.21819***	14.60	1	593
North East	.03024	1.30	-	174	.09366***	4.04	3	153
North West	.02971	1.54	-	334	.07882***	4.04	7	274
Northern Ireland	.02358	0.83	-	70	.0882***	3.23	5	74
Scotland	.03065*	1.83	5	489	.06313***	3.78	10	426
South East	.0533***	3.39	2	592	.09222***	5.54	4	437
South West	.03265*	1.66	4	309	.05368**	2.55	11	217
Wales	.01109	0.55	-	286	.09681***	5.05	2	286
West Midlands	.04084**	1.99	3	273	.07481***	3.51	8	210
Yorkshire	.03026	1.43	-	252	.07392***	3.48	9	208

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (masters degree), disaggregated by region; national baseline of individuals qualified to first degree level; N. is the number of individuals qualified to masters degree level in each region; R. is the rank of regions in order of magnitude of return to masters degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Relative to a national baseline of first degree holders, individuals from London have the most to gain from obtaining a masters degree, more than twice that of any other NUTS 1 region (.19666 for men and .21819 for women). Again, high returns are found in the high income South Eastern regions of the UK, with the South East of England NUTS 1 region displaying the second largest premium for men (although this is dwarfed by the London coefficient). Some of the regions that offered relatively small graduate premiums have large premiums for masters degree relative to first degree. For example, Wales has the second highest premium for women and the North East of England has the third largest premium. This is measured against a national baseline and therefore cannot be explained merely by relatively low first degree hourly earnings in these regions. Re-examination of the raw data (table 5.10 in the data and methodology section) reveals that masters degree earnings in these regions are relatively low. The results on the masters degree coefficients suggest that a large portion of the earnings increase in these regions is directly attributable to the possession of a masters degree. Wales has similarly low mean hourly earnings for both men and women at masters degree level, but no significant premium is paid to a masters degree relative to a first degree for men. This would suggest that the possession of a masters degree is poorly rewarded in Wales for men, compared to women. This may suggest that men obtaining a masters degree in Wales and the other regions that offer no premium relative to a national baseline may need to migrate to another region to obtain a return on their additional human capital investment, although, this does not take into account cost of living differences. These are accounted for when using a regional baseline in the next table.

Table 5.28 examines the premium paid to a masters degree relative to a first degree measured against a regional baseline. When restricted to within region effects, the masters degree premium found in London shrinks to .02992 for men and .04199 for women (although both remain significant). This fall can be attributed to the high first degree earnings observed in London. This implies that an individual qualified to first degree level in London stands to gain relatively little by obtaining a masters degree, whereas the previous table showed that relative to a national baseline, masters graduates find their highest returns in London. There are several other examples of an insignificant masters premium: men in the East of England, the East

Midlands, and Northern Ireland, and women in the East Midlands and Northern Ireland. The largest masters degree premiums are found in the West Midlands and the South West for men and the North East and Wales for women. In comparison to the national baseline results, coefficient estimates for Wales and the North East of England (amongst other regions) are greater when using a regional baseline, due to the below average hourly earnings in these regions at first degree level. Therefore, when taking account of cost of living differences, men in Wales are able to enjoy a return on their masters degrees.

Table 5.29 gives the returns to a PhD relative to a national baseline of masters holders. It is apparent from these results that a London effect dominates: only PhD holders in London enjoy an earnings advantage relative to a national baseline of masters degree holders. No other significant results are found using a national baseline. Restricting estimations to within region may shed more light on the PhD premium faced by those within that region.

When restricted to within region effects (table 5.30), positive returns to PhDs relative to masters degrees are found for women in the East Midlands and the South West. The majority of regions continue to show no significant PhD premium, which is due to the high earnings of masters degree holders across the UK.

Several studies in the existing literature measure the PhD premium relative to A level holders, instead of masters degree holders. This is shown in table 5.31, alongside the returns to first degrees and masters degrees (all relative to a national baseline of A level holders). From table 5.31, it can be seen that due to the high earnings of the London region, London offers the largest premiums, regardless of gender, at all qualification levels, although the increases between first degree, masters and PhD are small and there is an insignificant fall between the masters and PhD premiums for women. At both masters and PhD level, the highest returns for men outside of London are found in the South East and the South West. The South East also performs well at both levels for women.

Table 5.28

Returns to Masters Relative to First Degree by NUTS 1 Region (Regional Baseline)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
East	.00165	0.05	-	229	.05854*	1.77	7	171
East Midlands	.06115	1.63	-	156	.01312	0.34	-	127
London	.02992*	1.74	9	821	.04199**	2.27	10	593
North East	.09153***	2.89	3	174	.14367***	4.45	1	153
North West	.06745***	2.79	6	334	.08943***	3.81	3	274
Northern Ireland	.06846	1.43	-	70	.0431	0.98	-	74
Scotland	.04821**	2.40	7	489	.04955***	2.84	9	426
South East	.03884**	1.96	8	592	.06659***	3.14	5	437
South West	.09819***	3.85	2	309	.05418*	1.71	8	217
Wales	.07361**	2.57	5	286	.13063***	5.25	2	286
West Midlands	.11432***	4.10	1	273	.08242***	2.87	4	210
Yorkshire	.08014***	2.79	4	252	.05961**	1.98	6	208

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (masters degree), disaggregated by region; regional baseline of individuals qualified to first degree level; N. is the number of individuals qualified to masters degree level in each region; R. is the rank of regions in order of magnitude of return to masters degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.29

Returns to PhD Relative to Masters by NUTS 1 Region (National Baseline)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
East	-.00226	0.06	-	112	-.06429	1.17	-	48
East Midlands	-.07121	1.45	-	75	.04682	0.78	-	40
London	.14296***	4.39	1	176	.13115***	3.41	1	102
North East	-.02394	0.44	-	59	.00154	0.03	-	44
North West	-.00899	0.25	-	141	-.04166	0.95	-	77
Northern Ireland	-.09821	1.10	-	22	-.14551	1.39	-	13
Scotland	.03589	1.10	-	174	-.02556	0.68	-	105
South East	.02479	0.87	-	234	.00921	0.24	-	106
South West	.04123	0.97	-	100	.0389	0.77	-	57
Wales	-.00726	0.18	-	115	-.02336	0.43	-	50
West Midlands	.03251	0.68	-	79	.05308	0.81	-	34
Yorkshire	-.01381	0.32	-	96	-.01857	0.36	-	56

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (PhD), disaggregated by region; national baseline of individuals qualified to masters degree level; N. is the number of individuals qualified to PhD level in each region; R. is the rank of regions in order of magnitude of return to PhD; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.30

Returns to PhD Relative to Masters by NUTS 1 Region (Regional Baseline)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
East	.05998	1.05	-	112	-.04104	0.62	-	48
East Midlands	-.07701	1.01	-	75	.16251**	2.02	2	40
London	.01163	0.30	-	176	-.01562	0.35	-	102
North East	.00123	0.02	-	59	.03778	0.55	-	44
North West	.0071	0.17	-	141	.02797	0.55	-	77
Northern Ireland	.02403	0.24	-	22	.05844	0.52	-	13
Scotland	.04219	1.15	-	174	-.01809	0.47	-	105
South East	.04822	1.43	-	234	-.00041	0.01	-	106
South West	.05882	1.32	-	100	.19815***	2.79	1	57
Wales	.01974	0.39	-	115	-.07323	1.34	-	50
West Midlands	.05294	0.90	-	79	.09688	1.38	-	34
Yorkshire	.00665	0.12	-	96	.06015	0.87	-	56

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (PhD), disaggregated by region; regional baseline of individuals qualified to masters degree level; N. is the number of individuals qualified to PhD level in each region; R. is the rank of regions in order of magnitude of return to PhD; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.31

Returns Relative to A Level (National Baseline)

	First Degree		Masters		PhD	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
Male						
East	.20644***	14.90	.21885***	8.96	.29757***	8.54
East Midlands	.15211***	10.98	.22363***	7.54	.22941***	5.42
London	.39963***	44.72	.42633***	31.15	.45456***	16.17
North East	.12139***	8.39	.25307***	9.03	.27855***	5.86
North West	.15444***	15.05	.25281***	12.36	.30365***	9.65
North. Ireland	.1319***	5.49	.21243***	4.89	.14449*	1.87
Scotland	.18442***	19.33	.25441***	15.01	.33954***	12.00
South East	.26072***	28.25	.28859***	18.33	.33996***	13.84
South West	.14062***	11.98	.26842***	12.70	.34135***	9.28
Wales	.09993***	8.24	.22439***	10.20	.28681***	8.32
West Midlands	.14791***	11.99	.26365***	11.75	.33315***	8.05
Yorkshire	.14415***	11.92	.26223***	11.18	.28244***	7.46
Female						
East	.22745***	17.42	.31702***	11.58	.26982***	5.38
East Midlands	.19569***	14.16	.21875***	7.00	.37806***	6.86
London	.42947***	45.79	.48363***	31.05	.47214***	13.21
North East	.15996***	11.90	.33628***	11.70	.35586***	6.77
North West	.19658***	19.38	.30876***	14.14	.31505***	7.78
North. Ireland	.16312***	8.18	.24406***	6.03	.17475*	1.82
Scotland	.21917***	24.24	.30745***	17.15	.32177***	9.14
South East	.25568***	26.82	.35129***	19.75	.37161***	10.62
South West	.17725***	15.27	.2881***	11.80	.36254***	7.79
Wales	.14713***	12.99	.33649***	15.62	.31409***	6.31
West Midlands	.20869***	16.80	.30928***	12.36	.40213***	6.73
Yorkshire	.18826***	15.75	.30523***	12.27	.33717***	7.16

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters or PhD), disaggregated by region; national baseline of individuals qualified to A level; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Using a regional baseline, London moves to the foot of the rankings for both men and women at all qualification levels, due to the high earnings of A level holders in the region (table 5.32). Relative to A level, the highest masters premium is found for men in the West Midlands and the North East, and for women in the North East and Wales. These regions also performed very well against a baseline of first degree holders. At PhD level, the greatest male returns are found in the South West and West Midlands and the greatest female returns are in the East Midlands and the West Midlands. Several PhD premiums are lower than their corresponding masters premiums (although the difference is often insignificant), suggesting there is little advantage to holding a PhD over a masters degree in these regions.

Subject Areas

Table 5.33 focuses on differences in the graduate premium by choice of undergraduate subject group.[51] In table 5.33, the hourly earnings of individuals possessing a degree in a specific subject group (i.e. biological sciences) are regressed against a baseline of A level holders. The largest coefficient (by some margin) is found for those with an undergraduate degree in the subject area of medicine and dentistry (.51898 for men and .534 for women), a result previously found by Blackaby, Murphy and O'Leary (1999). Whilst it may be expected that an individual possessing a degree in this subject area will have a larger graduate premium than an individual whose degree is in another area, the magnitude of this earnings advantage may be somewhat misleading. An individual who has obtained an undergraduate degree is compensated in the labour market for their increased human capital and the time investment they have made pursuing this degree. This is generally three years, for most undergraduate degrees, however, those who have studied in the medicine and dentistry area are likely to have taken more three years to complete their first degree, and the pecuniary rewards reflect this. This may account for some of the gap in the graduate premium between medicine and dentistry and the subject areas displaying the next highest premiums.

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[51] Due to a classification change in the APS between 2004 and 2005, we only use degree subject data from 2005 onwards.

Table 5.32

Returns Relative to A Level (Regional Baseline)

	First Degree		Masters		PhD	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
Male						
East	.16945***	8.26	.19216***	6.07	.27811***	6.07
East Midlands	.21083***	10.33	.2995***	8.51	.22368***	4.31
London	.16449***	11.37	.18476***	9.37	.23796***	6.46
North East	.18969***	10.04	.32872***	10.75	.35177***	7.01
North West	.20944***	15.07	.30185***	12.77	.33606***	9.21
North. Ireland	.23458***	6.82	.31476***	5.72	.25212***	2.77
Scotland	.21492***	17.42	.29771***	15.64	.37339***	11.97
South East	.19732***	14.57	.23114***	11.24	.29037***	9.48
South West	.17551***	10.75	.31513***	12.49	.40454***	9.60
Wales	.18062***	10.47	.31158***	11.49	.348***	8.26
West Midlands	.19231***	11.19	.3311***	12.44	.38838***	8.42
Yorkshire	.18811***	11.76	.31326***	11.68	.30312***	6.96
Female						
East	.17566***	8.24	.30021***	7.58	.28843***	4.63
East Midlands	.24146***	11.51	.30708***	8.09	.49727***	7.64
London	.16352***	9.85	.21715***	9.03	.2063***	3.90
North East	.19494***	10.27	.42674***	12.64	.36334***	6.33
North West	.21924***	15.73	.35397***	13.96	.38476***	8.33
North. Ireland	.18336***	5.20	.26985***	4.52	.08961	0.61
Scotland	.21763***	18.46	.32823***	15.54	.36198***	8.85
South East	.17409***	12.32	.2779***	11.99	.30587***	7.05
South West	.1875***	10.56	.33016***	10.46	.37349***	6.78
Wales	.15217***	9.23	.37515***	14.02	.31542***	5.44
West Midlands	.23056***	12.23	.36502***	11.40	.49642***	7.20
Yorkshire	.22782***	13.04	.36055***	11.59	.4226***	7.43

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters or PhD), disaggregated by region; regional baseline of individuals qualified to A level; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.33

Returns to First Degree Relative to A Level by Subject Area

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Medicine & Dent	.51898***	16.24	1	141	.534***	19.98	1	203
Medicine Related	.20613***	9.65	9	306	.30599***	28.47	4	1,444
Biological Sci.	.13921***	9.30	16	630	.18742***	15.06	16	931
Vet. & Agric.	.17339***	5.66	14	141	.12759***	4.20	20	133
Physical Sciences	.20556***	17.47	10	1,064	.21893***	12.43	13	437
Maths & Comp	.23334***	20.13	5	1,212	.26008***	14.37	7	430
Engineering	.24617***	27.16	4	2,059	.29137***	9.87	5	143
Technologies	.14223***	4.79	15	150	.16726***	4.09	17	72
Architecture	.20491***	11.96	11	487	.21908***	7.30	12	138
Economics	.31796***	16.55	2	373	.32448***	11.98	2	167
Politics	.21545***	7.47	8	161	.26488***	8.34	6	119
Social Studies	.19493***	11.67	13	496	.22028***	18.64	11	1,010
Law	.29635***	16.09	3	416	.30854***	18.18	3	500
Business Admin.	.2224***	20.84	7	1,354	.21575***	20.52	14	1,326
Mass Comms.	.06185**	2.08	19	150	.14844***	6.57	19	239
Ling. & Classics	.12561***	5.36	17	246	.23716***	15.72	9	597
Language & Lit	.20207***	7.08	12	165	.23351***	12.36	10	351
History & Phil.	.08326***	5.21	18	560	.19159***	12.32	15	549
Arts	.05996***	3.85	20	579	.15443***	11.56	18	775
Education	.23272***	11.35	6	376	.25992***	18.98	8	1,335

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by subject area; national baseline of individuals qualified to A level; N. is the number of individuals qualified to first degree level in each subject area; R. is the rank of subject areas in order of magnitude of return to first degree; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

The second highest graduate premium for both men and women is found for those who studied economics at first degree level (.31796 and .32448), followed by law (.29635 and .30854). Previous strong returns to economics and law have been obtained by Blundell *et al.* (2000) and Walker and Zhu (2010). Results for these three subjects confirm my earlier finding (and the findings of previous studies) that women have more to gain by obtaining a degree than men. In fact, of the twenty subject areas in the data, only two subjects (veterinary and agricultural studies and business administration) show the graduate premium for men exceeding the graduate premium for women. The difference in the graduate premium by gender is very small for business administration (.2224 to .21575), but far larger for veterinary and agricultural studies (.17339 to .12759). All coefficients are highly significant and positive, confirming that, regardless of subject area chosen, all who obtain a first degree will enjoy an earnings premium over those who are qualified up to A level. The smallest graduate premiums are found for men with first degrees in arts (.05996), mass communications (.06185), and history and philosophy (.08326). Blackaby, Murphy and O'Leary (1999) have also found arts to offer the smallest graduate premium.

Table 5.34 examines the premium paid to a masters degree relative to a first degree, by subject area. It was previously found that the premium for a masters degree relative to a first degree is .06713 for men and .07905 for women. It should be noted that the effect of gaining a masters degree relative to a first degree is found to be insignificant for twelve of the twenty subject areas for men and eleven of the twenty subject areas for women. The masters degree premiums that are observed with a level of significance of at least 10% vary greatly in their magnitude. For both genders, the greatest masters degree premiums are found in the subject areas of veterinary and agricultural studies (.14536 and .17353) and business administration (.11652 and .13453). The strong performance of business administration at masters level has also been found by O'Leary and Sloane (2005). Where significant masters premiums are found in the same subject area for both genders, the female premium is always greater in magnitude. Engineering and law are the only subject areas that offer a masters premium to men but not to women. All significant masters premiums are positive. The existence of insignificant results and the variation in significant

Table 5.34

Returns to Masters Relative to First Degree by Subject Area

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Medicine & Dent	-.08557	1.13	-	36	.05321	0.63	-	31
Medicine Related	.09633**	2.05	3	103	.11612***	5.46	5	247
Biological Sci.	.09177**	2.33	4	130	.10668***	3.57	8	219
Vet. & Agric.	.14536*	1.84	1	49	.17353**	2.27	1	37
Physical Sciences	.00705	0.25	-	240	.09906**	2.26	9	123
Maths & Comp	.02551	1.10	-	406	.04898	1.19	-	141
Engineering	.09151***	4.51	5	451	.08801	1.35	-	63
Technologies	.12643	1.40	-	36	-.00532	0.05	-	20
Architecture	-.00225	0.06	-	124	.07597	1.13	-	51
Economics	.04081	0.82	-	95	-.04396	0.57	-	43
Politics	-.06744	0.79	-	55	-.01545	0.20	-	47
Social Studies	.06837*	1.69	8	151	.11248***	4.89	6	311
Law	.08329*	1.78	6	127	.07982	1.47	-	78
Business Admin.	.11652***	5.64	2	779	.13453***	5.88	2	406
Mass Comms.	.07706	1.32	-	80	.13398***	3.06	3	106
Ling. & Classics	-.01229	0.18	-	61	.06495	1.60	-	131
Language & Lit	-.00823	0.10	-	37	-.01997	0.37	-	64
History & Phil.	.05499	1.43	-	164	.03958	1.00	-	144
Arts	.07487*	1.80	7	116	.10821***	2.81	7	109
Education	.01727	0.49	-	151	.11908***	4.57	4	245

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (masters degree), disaggregated by subject area; national baseline of individuals qualified to first degree level, disaggregated by subject area; N. is the number of individuals qualified to masters degree level in each subject area; R. is the rank of subject areas in order of magnitude of return to masters degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

results suggest that the choice of undertaking a masters degree course is highly dependent upon the degree subject area, more so than at first degree level, where all subject areas provided an earnings advantage, albeit at varying magnitudes. Further insight may be gained from examining the PhD premium.

Positive and significant earnings differences between PhD and masters are found for men with PhDs in physical sciences. It is possible that subject areas that offer high earnings at PhD level also reward masters degrees highly. These high earnings at masters level could account for many of the insignificant results in table 5.35.

Table 5.36 estimates premiums at first degree, masters and doctorate levels relative to A level holders across the twenty subject areas. Relative to A level holders, graduates in medicine and dentistry continue to display the largest returns at all qualification levels. Outside of medicine and dentistry, the largest masters premiums for men are found in law and business administration, and the largest masters premiums for women are found in law and education. Men in business administration and women in education also do very well at PhD level, displaying the largest returns after medicine and dentistry.

Table 5.23, which presented the mark up to a first degree relative to A level by degree classification showed similar returns for first and upper second class degrees and also lower second and third class degrees. Whilst I may have expected the graduate premium to rise uniformly with degree class, table 5.23 revealed some inconsistencies: Returns to an upper second class degree are greater than those for a first class degree for women, although this difference is small (.26826 to .24912). Table 5.37 examines these effects by first degree subject. Immediately it can be seen that there is great variation in returns to first degree class depending on the subject area. For men who chose to study medicine and dentistry, the returns to a first class degree are .34534, far smaller than returns to an upper second class degree (.78219). Similar effects are found for other subject areas, such as women who studied physical sciences and engineering. The clearest example of this effect is for women

Table 5.35

Returns to PhD Relative to Masters by Subject Area

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Medicine & Dent	.10051	1.23	-	75	.05034	0.57	-	55
Medicine Related	.03571	0.54	-	72	.01861	0.41	-	64
Biological Sci.	.03424	0.72	-	219	-.0112	0.29	-	214
Vet. & Agric.	-.05721	0.39	-	17	.11437	1.02	-	15
Physical Sciences	.08282**	2.37	1	346	-.0545	0.94	-	92
Maths & Comp	.04585	0.92	-	103	.06116	0.74	-	22
Engineering	.02128	0.49	-	133	.09856	0.72	-	20
Technologies	-.4489**	2.13	-	22	-	-	-	5
Architecture	-.01804	0.09	-	4	-.12717	0.66	-	4
Economics	-.01328	0.11	-	26	.00827	0.04	-	6
Politics	.19352	0.94	-	11	-.16158	0.51	-	4
Social Studies	-.04644	0.61	-	40	.0028	0.04	-	32
Law	-.10061	0.56	-	10	.08446	0.37	-	8
Business Admin.	.13259	1.46	-	24	-.40891***	3.45	-	15
Mass Comms.	-.00256	0.01	-	3	.31319	1.36	-	4
Ling. & Classics	-.09421	0.77	-	25	.00113	0.01	-	26
Language & Lit	.15821	1.02	-	12	-.15358	0.91	-	12
History & Phil.	.03777	0.50	-	57	-.09608	1.06	-	30
Arts	-.01912	0.19	-	16	-.08696	0.56	-	8
Education	.01266	0.14	-	24	.08529	0.98	-	17

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (PhD), disaggregated by subject area; national baseline of individuals qualified to masters degree level, disaggregated by subject area; N. is the number of individuals qualified to PhD level in each subject area; R. is the rank of subject areas in order of magnitude of return to PhD; (-) denotes an insignificant or negative return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.36

Returns Relative to A Level by Subject Area

	First Degree		Masters		PhD	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
Male						
Medicine & Dentistry	.51898***	16.24	.55184***	9.06	.62051***	14.45
Medicine Related	.20613***	9.65	.34466***	9.45	.43852***	10.16
Biological Sciences	.13921***	9.30	.24408***	7.58	.26989***	10.60
Veterinary & Agric.	.17339***	5.66	.23259***	4.50	.27156***	3.10
Physical Sciences	.20556***	17.47	.20149***	8.48	.30727***	15.08
Maths & Comp. Sci.	.23334***	20.13	.26551***	13.97	.30193***	8.31
Engineering	.24617***	27.16	.30789***	17.26	.34808***	10.77
Technologies	.14223***	4.79	.25524***	4.24	.18017**	2.34
Architecture	.20491***	11.96	.21207***	6.45	.35473**	1.97
Economics	.31796***	16.55	.34398***	9.22	.34927***	4.91
Politics	.21545***	7.47	.13277***	2.72	.30312***	2.79
Other Social Sciences	.19493***	11.67	.27175***	9.07	.27079***	4.64
Law	.29635***	16.09	.41185***	12.73	.32348***	2.84
Business Admin.	.2224***	20.84	.38159***	27.88	.47787***	6.47
Mass Comms.	.06185**	2.08	.16665***	4.08	.04053	0.19
Linguistics & Classics	.12561***	5.36	.18632***	4.01	.18758**	2.53
Language & Lit.	.20207***	7.08	.18012***	3.02	.25918**	2.49
History & Philosophy	.08326***	5.21	.12895***	4.46	.20621***	4.26
Arts	.05996***	3.85	.19849***	5.81	.18445**	2.04
Education	.23272***	11.35	.30131***	9.81	.32315***	4.37
Female						
Medicine & Dentistry	.534***	19.98	.60569***	9.54	.64739***	13.48
Medicine Related	.30599***	28.47	.43265***	19.11	.4654***	10.57
Biological Sciences	.18742***	15.06	.30446***	12.29	.32337***	12.56
Veterinary & Agric.	.12759***	4.20	.30041***	5.24	.41056***	4.62
Physical Sciences	.21893***	12.43	.25754***	8.11	.27928***	7.55
Maths & Comp. Sci.	.26008***	14.37	.30152***	9.98	.37652***	5.10
Engineering	.29137***	9.87	.33841***	7.71	.44182***	5.70
Technologies	.16726***	4.09	.20005***	2.60	.33942**	2.20
Architecture	.21908***	7.30	.25856***	5.31	.32841*	1.92
Economics	.32448***	11.98	.31164***	5.93	.3135**	2.24
Politics	.26488***	8.34	.24624***	4.85	.26884	1.57
Other Social Sciences	.22028***	18.64	.34009***	16.36	.3744***	6.07
Law	.30854***	18.18	.43617***	11.10	.40398***	3.33
Business Admin.	.21575***	20.52	.41078***	22.79	.05295	0.58
Mass Comms.	.14844***	6.57	.28382***	8.30	.42712**	2.49
Linguistics & Classics	.23716***	15.72	.31611***	10.16	.35413***	5.22
Language & Lit.	.23351***	12.36	.20516***	4.74	.11412	1.15
History & Philosophy	.19159***	12.32	.24798***	8.42	.16509***	2.60
Arts	.15443***	11.56	.31119***	9.23	.27423**	2.26
Education	.25992***	18.98	.43315***	17.60	.52565***	6.27

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters degree or PhD), disaggregated by subject area; national baseline of individuals qualified to A level, disaggregated by subject area; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.37

Returns to First Degree Relative to A Level by Degree Classification and Subject Area

	Male		Female	
	Coeff.	**t stat**	**Coeff.**	**t stat**
Medicine & Dentistry				
First	.34534***	3.56	.63361***	6.86
Upper Second	.78219***	4.85	.43331***	5.76
Lower Second	.28272	1.11	.40053***	3.09
Third	-	-	.31379	0.92
Medicine Related				
First	.09142	1.04	.24057***	6.41
Upper Second	.21336***	4.25	.3391***	15.48
Lower Second	.24237***	3.74	.2988***	9.25
Third	-.27088	0.75	.44947***	5.39
Biological Sciences				
First	.25925***	3.93	.22817***	4.36
Upper Second	.15649***	4.38	.21414***	7.59
Lower Second	.09107**	2.37	.1614***	5.04
Third	.01809	0.22	.09122	0.96
Veterinary & Agric.				
First	.22999	1.56	.2019*	1.67
Upper Second	.29355***	3.16	.20553***	3.27
Lower Second	.12004	1.29	.17893*	1.81
Third	-.02195	0.15	-.17103	0.71
Physical Sciences				
First	.27014***	5.99	.19065***	2.66
Upper Second	.23187***	7.37	.24764***	5.91
Lower Second	.19137***	5.92	.32205***	6.90
Third	.0601	1.14	.31279**	2.42
Maths & Computing Sci.				
First	.23412***	5.65	.24813***	3.87
Upper Second	.2367***	8.81	.2847***	6.79
Lower Second	.22486***	6.77	.22942***	4.40
Third	.18724***	3.42	.12078	1.27
Engineering				
First	.34351***	10.72	.2733***	3.18
Upper Second	.28781***	12.89	.31348***	4.63
Lower Second	.18243***	7.26	.34664***	2.86
Third	.25791***	5.33	.40354**	2.02
Technologies				
First	.30548**	2.40	.3357**	2.19
Upper Second	.01954	0.25	.0349	0.29
Lower Second	.22985***	2.99	.12396	1.02
Third	.10965	0.80	.04578	0.19
Architecture				
First	.31485***	3.80	.16926	1.21
Upper Second	.24103***	5.73	.1363*	1.94
Lower Second	.10743**	2.10	.17034**	2.10
Third	.10532	0.77	.23791	1.39
Economics				
First	.51075***	5.48	.52487***	3.43
Upper Second	.34303***	6.57	.36567***	5.53

Lower Second	.2394***	4.68	.21931***	3.25
Third	-.04958	0.24	.0649	0.46
Politics				
First	-.02308	0.17	.18646	0.94
Upper Second	.17253***	2.78	.34371***	4.01
Lower Second	.17486**	2.33	.3386***	3.56
Third	.05146	0.14	-	-
Social Studies				
First	.23294***	2.58	.26992***	5.49
Upper Second	.22348***	5.13	.23674***	9.30
Lower Second	.21864***	4.57	.23592***	7.76
Third	.18831	1.48	.08927	0.64
Law				
First	.2462***	2.89	.50045***	6.79
Upper Second	.33034***	6.38	.32487***	8.57
Lower Second	.26468***	5.17	.34351***	8.05
Third	.04563	0.36	.519***	3.37
Business Administration				
First	.18444***	4.12	.22003***	5.53
Upper Second	.30213***	12.27	.30501***	14.20
Lower Second	.17442***	6.29	.16396***	6.13
Third	.17406**	2.26	.24317**	2.13
Mass Communications				
First	.51978***	3.53	.11365	1.37
Upper Second	.06935	1.15	.21421***	4.61
Lower Second	-.01414	0.18	.04623	0.71
Third	-.00332	0.02	.18354	0.76
Linguistics & Classics				
First	.01881	0.17	.17964***	2.77
Upper Second	.18882***	3.58	.23613***	7.85
Lower Second	.06236	0.86	.24752***	5.97
Third	.19661	0.95	.05919	0.39
Language & Literature				
First	-.24179	0.95	.19969**	2.25
Upper Second	.11148	1.57	.28456***	6.79
Lower Second	.20719**	2.30	.25327***	4.93
Third	.51355	1.43	-.16473	0.48
History & Philosophy				
First	.11641	1.58	.26267***	2.87
Upper Second	.06704**	1.96	.24847***	7.32
Lower Second	.16598***	3.89	.19248***	4.34
Third	.17339	1.08	.09035	0.65
Arts				
First	.07892	1.20	.16489***	2.92
Upper Second	.10367***	3.08	.15833***	5.62
Lower Second	-.06864*	1.68	.16882***	5.05
Third	-.0769	0.57	.04796	0.49
Education				
First	.17199**	2.07	.17993***	4.15
Upper Second	.27618***	6.32	.30412***	12.50
Lower Second	.2429***	5.01	.26539***	9.93
Third	.14562	0.99	.04831	0.58

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by class of first degree; national baseline of individuals qualified to A level; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

who have obtained medicine related first degrees. Their graduate premium actually decreases uniformly as degree class increases, from .44947 for third class degrees to .24057 for first class degrees. It may be possible to explain these effects by considering that as undergraduate degree classification increases, so does the probability that a person will continue their education and go on to attain a higher degree (such as masters or doctorate). These individuals will then not be included in the undergraduate degree group and may have filled jobs that otherwise would have gone to individuals possessing a high class of undergraduate degree only, thereby lowering the earnings of that group.[52] Checking the premium paid to masters degree relative to first degree for women studying in medicine related subjects, a mark up of .11612 is found, greater than that of the premium of a masters degree relative to a first degree across all subjects for females, .07905. For many subject areas, such as economics and biological sciences, the graduate premium does increase uniformly with degree classification. Several reflect the female result of upper second class returns exceeding first class returns and falling thereafter. I also find third class degrees to offer insignificant returns relative to A level for over half of the gender/subject area groups.

Table 5.38 looks at the graduate premium by region and subject area relative to a national baseline of A level holders. The table identifies where in the UK the top three graduate premiums exist for each subject area (also disaggregated by gender). This would suggest where a mobile graduate should locate in order to maximise their earnings relative to a national baseline of A level holders, given the subject area they have graduated in. Given the large aggregated graduate premiums found in London (.39963 for men and .42947 for women) it is no surprise that London offers the largest graduate premium in 15 of the 20 subject areas, for both genders. In fact, there are only two subject areas for men (technologies and education) and two for women (medicine and dentistry, and economics), where London does not offer one of the top three graduate premiums. In two of these cases (technologies for men and

[52] Data on class of first degree, if the respondent has also achieved a higher degree is included from 2007 onwards (APS variable degcls7). However, when split across subject areas and degree class, observations are insufficient to test this.

economics for women), the South East provides the greatest returns. For men studying mass communications and arts, the only positive and significant graduate premiums are found in London: no other region offers these first degree holders an earnings advantage over A level holders. This helps explain the low national graduate premiums for these two subject areas, as they are being driven entirely by London based graduates. Whilst table 5.38 identifies the largest graduate premiums in each subject area against a national baseline, it fails to take into account regional cost of living differences, which may have implications regarding migration of graduates.

Table 5.39 considers the graduate premium by subject using a regional baseline. Against a regional baseline, the dominance of London, and to a lesser extent the South East, is greatly reduced. The highest female graduate premium in veterinary and agricultural studies is found in London and London also offers top three premiums for men in the subject areas of social sciences and history and philosophy. The difference in these results may affect possible migration decisions, as when cost of living differences are controlled for, the ranking of regions by subject changes, dramatically in some cases. In some subject areas the greatest returns are offered by the same region for both genders, which suggests that demand for specific subject qualifications is high in these regions regardless of gender (for example, business administration in the East Midlands and Yorkshire, and maths and computer science in the East Midlands and Scotland). The subject areas of mass communications and linguistics and classics offered amongst the smallest graduate premiums for men when regions were aggregated to a national level. At a regional level I find no premiums for mass communications and only a graduate premium for linguistics and classics in the West Midlands. This is likely due to the small sample sizes required at this level of disaggregation.

Table 5.38

Top Regional Graduate Premiums by Subject (National Baseline)

	Male				Female			
	Reg.	**Coeff.**	**t stat**	**N.**	**Reg.**	**Coeff.**	**t stat**	**N.**
Medicine & Dent	EM	.68202***	4.63	6	SCO	.79607***	12.90	32
	LON	.61535***	7.58	20	E	.67018***	4.70	6
	NE	.61505***	6.13	13	SW	.65681***	5.42	9
Medicine Related	WM	.28883***	3.74	22	LON	.44447***	13.74	118
	LON	.28417***	4.64	35	SE	.33896***	11.52	142
	SCO	.27751***	4.61	36	EM	.31998***	8.07	76
Biological Sci.	LON	.32601***	8.63	93	LON	.43567***	13.27	114
	SE	.17613***	4.61	90	SE	.22372***	7.62	143
	E	.17379***	2.97	38	SW	.22192***	5.98	87
Vet. & Agric.	LON	.46122***	4.96	15	LON	.585***	5.91	12
	EM	.36641***	3.05	9	SW	.16946*	1.78	13
	SE	.23794**	2.47	14	SE	.1478*	1.78	17
Physical Sciences	LON	.36037***	11.13	129	LON	.48945***	9.95	49
	SE	.2692***	9.68	172	SE	.27923***	6.75	73
	E	.2626***	5.63	62	E	.27461***	3.99	25
Maths & Comp	LON	.4336***	15.46	175	LON	.47974***	10.62	59
	SE	.29559***	12.01	229	EM	.38172***	5.10	21
	E	.29417***	6.53	65	SCO	.30765***	7.31	68
Engineering	LON	.39374***	16.01	225	LON	.39824***	4.63	16
	SE	.32675***	15.88	325	SE	.35881***	5.51	28
	NW	.24259***	9.53	209	NE	.3209***	2.65	8
Technologies	SE	.3989***	4.95	20	NW	.34302***	3.60	14
	NE	.3527*	1.70	3	LON	.33278***	2.91	9
	SCO	.31981***	2.95	12	WA	.29326*	1.92	5
Architecture	LON	.36374***	8.80	79	E	.54472***	2.73	3
	E	.3385***	4.60	24	EM	.35043***	2.89	8
	EM	.2547***	3.31	22	LON	.28861***	4.48	29
Economics	LON	.51604***	14.33	104	SE	.42703***	6.90	31
	SCO	.32669***	5.94	43	NW	.38783***	4.24	14
	SW	.29832***	4.22	26	WM	.37563***	3.64	11
Politics	NI	.64136**	2.52	2	LON	.4463***	5.66	19
	SE	.42661***	5.16	19	SE	.36554***	4.27	16
	LON	.32803***	5.82	42	WM	.349***	3.06	9
Social Studies	LON	.4851***	11.31	72	LON	.40986***	13.25	127
	E	.26292***	3.79	27	WM	.23761***	5.72	69
	SW	.25041***	3.74	29	SCO	.2364***	8.14	144
Law	LON	.47858***	12.96	99	LON	.50685***	14.26	101
	SE	.36614***	7.15	50	E	.41794***	5.69	22
	YOR	.34622***	4.89	26	SE	.38216***	8.91	65
Business Admin.	LON	.38382***	16.11	245	LON	.43651***	17.29	199
	SE	.32273***	11.59	173	SE	.29341***	10.18	148

	E	.27228***	6.52	75	E	.25223***	5.99	68
Mass Comms.	LON	.28135***	4.12	28	LON	.32015***	6.18	44
	-	-	-	-	EM	.2308*	1.90	8
	-	-	-	-	E	.2084**	2.02	11
Ling. & Classics	LON	.32486***	6.54	54	LON	.48815***	15.22	120
	E	.23082*	1.92	9	NI	.31715***	2.61	8
	SE	.14055**	2.17	32	E	.26827***	4.49	33
Language & Lit	LON	.41006***	7.54	45	LON	.46406***	11.96	79
	E	.34244***	3.01	10	WM	.26665***	3.89	26
	SE	.32155***	4.09	21	SE	.23413***	5.06	55
History & Phil.	LON	.35046***	9.86	105	LON	.45906***	13.16	98
	SW	.13442**	2.50	45	E	.27675***	4.84	36
	SE	.09891**	2.15	62	SCO	.25838***	5.62	56
Arts	LON	.29843***	8.09	98	LON	.31801***	9.89	118
	-	-	-	-	NI	.21873**	2.02	11
	-	-	-	-	EM	.1859***	3.55	44
Education	YOR	.3788***	4.57	19	SCO	.37951***	14.64	218
	NI	.37871***	4.19	16	NI	.37413***	4.96	22
	E	.35752***	3.95	16	LON	.30597***	8.53	101

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by subject area and region; national baseline of individuals qualified to A level; N. is the number of individuals qualified to first degree level in each subject area and region; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; REG denotes region; region names have been abbreviated to: East (E), East Midlands (EM), London (LON), North East (NE), North West (NW), Northern Ireland (NI), Scotland (SCO), South East (SE), South West (SW), Wales (WA), West Midlands (WM) and Yorkshire (YOR).

Table 5.39

Top Regional Graduate Premiums by Subject (Regional Baseline)

	Male				Female			
	Reg.	Coeff.	t stat	N.	Reg.	Coeff.	t stat	N.
Medicine & Dent	EM	.65161***	4.40	6	SCO	.84404***	13.03	32
	NE	.63013***	6.39	13	E	.80085***	4.35	6
	WA	.607***	5.71	12	SW	.67373***	5.43	9
Medicine Related	WM	.35946***	4.69	22	EM	.41673***	9.85	76
	SCO	.31602***	5.40	36	NW	.34841***	11.18	147
	NI	.30799**	2.24	6	YOR	.34385***	9.05	110
Biological Sci.	NI	.24301**	1.97	7	SW	.24295***	5.95	87
	WA	.19724***	3.99	52	SCO	.23102***	7.65	136
	YOR	.16487***	3.11	44	NW	.19132***	5.39	104
Vet. & Agric.	EM	.39688***	3.35	9	LON	.33042***	2.93	12
	WM	.2349**	2.16	11	SW	.17584*	1.82	13
	NI	.21458*	1.81	8	-	-	-	-
Physical Sciences	NE	.27053***	5.63	51	EM	.28898***	4.09	22
	NW	.26375***	7.87	122	NE	.25863***	4.13	31
	SW	.24837***	6.21	83	SCO	.25372***	5.25	49
Maths & Comp	SW	.30092***	7.63	95	EM	.47792***	6.44	21
	SCO	.27326***	9.09	157	SCO	.35085***	8.39	68
	EM	.27128***	5.82	70	WM	.29279***	4.80	36
Engineering	NI	.31338***	4.21	31	NI	.37657**	1.99	3
	NW	.30611***	11.19	209	NE	.37251***	3.32	8
	NE	.28099***	7.44	93	SCO	.36662***	4.78	18
Technologies	NE	.39558**	2.11	3	NW	.39793***	4.19	14
	SCO	.33139***	3.21	12	WA	.3771***	2.66	5
	SE	.32229***	3.68	20	EM	.22709*	1.75	6
Architecture	NI	.45396***	2.94	5	E	.62925**	2.47	3
	E	.31282***	3.94	24	EM	.4322***	3.74	8
	EM	.29397***	3.78	22	NW	.32844***	3.38	12
Economics	SW	.37642***	5.42	26	NW	.42161***	4.73	14
	SCO	.36343***	6.88	43	WM	.42059***	4.05	11
	YOR	.33936***	5.09	26	EM	.40409***	3.55	8
Politics	NI	.71707***	3.14	2	WM	.38988***	3.45	9
	SE	.36055***	4.02	19	EM	.35677***	3.70	11
	SCO	.35062***	4.21	17	YOR	.29597**	1.97	5
Social Studies	SW	.28805***	4.35	29	EM	.29779***	6.42	57
	LON	.24529***	5.22	72	WM	.27625***	6.22	69
	E	.23599***	3.13	27	SCO	.26098***	9.08	144
Law	YOR	.41683***	6.18	26	E	.39586***	4.57	22
	WM	.38901***	4.98	21	SCO	.3537***	8.34	73
	SCO	.37269***	7.46	49	YOR	.35155***	5.05	26
Business Admin.	NI	.32188***	4.86	34	SW	.27293***	6.93	92
	EM	.26582***	5.74	68	EM	.26734***	5.86	58

	YOR	.25804***	7.58	110	YOR	.24187***	6.53	97
Mass Comms.	-	-	-	-	EM	.29193**	2.43	8
	-	-	-	-	YOR	.25652***	3.49	21
	-	-	-	-	WM	.17933*	1.80	12
Ling. & Classics	WM	.1757**	2.27	20	NI	.3692***	2.88	8
	-	-	-	-	YOR	.28858***	5.73	51
	-	-	-	-	NW	.23957***	5.15	57
Language & Lit	E	.29728**	2.45	10	WM	.31517***	4.58	26
	SE	.2607***	3.07	21	NI	.25736*	1.67	5
	SW	.21451**	2.15	12	SW	.24155***	3.21	22
History & Phil.	SW	.18256***	3.44	45	SCO	.29527***	6.86	56
	WM	.11087*	1.92	39	E	.22052***	3.47	36
	LON	.10443***	2.59	105	WM	.20479***	3.65	41
Arts	WA	.11908**	2.35	50	NI	.25423**	2.43	11
	WM	.1181**	2.30	48	EM	.23476***	4.45	44
	SCO	.07542*	1.68	61	SCO	.18696***	4.84	79
Education	NI	.44391***	4.21	16	SCO	.40789***	11.82	218
	YOR	.41059***	5.05	19	NW	.32788***	9.16	133
	WA	.31609***	5.53	49	YOR	.31695***	6.93	105

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by subject area and region; regional baseline of individuals qualified to A level; N. is the number of individuals qualified to first degree level in each subject area and region; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels; REG denotes region; region names have been abbreviated to: East (E), East Midlands (EM), London (LON), North East (NE), North West (NW), Northern Ireland (NI), Scotland (SCO), South East (SE), South West (SW), Wales (WA), West Midlands (WM) and Yorkshire (YOR).

Industry

Table 5.40 looks at the earnings premium paid to first degree holders relative to A level holders, disaggregated by the industry sector the individual is employed in. Results show that the possession of a first degree provides a significant earnings advantage over A level holders for all industry sectors, except for those working in agriculture and fishing (where the graduate premium is insignificant). The industries in which the possession of a first degree brings the largest earnings advantage are energy and water (.28948 for men and .24944 for women) and manufacturing (.25402 for men and .26916 for women).

The masters degree premium is also estimated relative to first degree by industry sector (table 5.41). The energy and water industry sector, which offered large first degree premiums, fails to reward possession of a masters degree over a first degree. Manufacturing also offered a very large graduate premium, but there are positive and significant masters premiums to be found also. The greatest masters degree premium for men is in the distribution, hotels and restaurants industry sector (.10087), followed by banking, finance and insurance (.08138), whilst the largest masters degree returns for women are found in transport and communications (.09812), which is close in magnitude to the figure for the public administration, education and health sector (.09355) . As with first degrees (relative to A levels), masters degrees offer no earnings advantage relative to first degrees in the agriculture and fishing sector.

Only a few industry sectors offer a premium to PhD holders relative to masters (table 5.42). The largest premium for women is found in the construction industry (.28388) and the largest premium for men is in the manufacturing sector (11566). The only other significant advantage to holding a doctorate over a masters degree is in the public administration, education and health sector (.03492 for men and .0365 for women). This shows that, even though no PhD premium was found at an aggregated level, PhD premiums exist for smaller groups. For men I also find one

Table 5.40

Returns to First Degree Relative to A level by Industry Sector

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Agric. & Fishing	.03693	0.51	-	45	.08422	0.88	-	38
Energy & Water	.28948***	9.58	1	321	.24944***	4.69	2	106
Manufacturing	.25402***	25.65	2	2,321	.26916***	13.74	1	977
Construction	.23507***	12.81	3	668	.15756***	3.23	7	157
Dist., Hotels & Rest	.18657***	12.52	5	1,014	.15512***	9.90	8	952
Transport & Comm	.20124***	11.35	4	712	.20095***	7.18	4	350
Banking & Finance	.18194***	15.32	6	3,801	.17661***	13.92	6	2,388
Pub Admin, Educ	.17375***	20.23	7	4,330	.22768***	35.20	3	8,853
Other Services	.12811***	4.98	8	683	.18061***	7.70	5	666

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by industry; national baseline of individuals qualified to A level, disaggregated by industry; N. is the number of individuals qualified to first degree level in each industry; R. is the rank of industry sectors in order of magnitude of return to first degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.41

Returns to Masters Relative to First Degree by Industry Sector

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Agric. & Fishing	.10711	0.54	-	13	.02227	0.11	-	12
Energy & Water	.0219	0.49	-	91	.10739	1.11	-	23
Manufacturing	.04595***	2.59	6	554	.07303**	2.33	4	191
Construction	.07876**	2.07	3	121	.10957	1.17	-	36
Dist., Hotels & Rest	.10087***	2.70	1	194	.08169*	1.80	3	117
Transport & Comm	.05465	1.54	-	176	.09812*	1.78	1	63
Banking & Finance	.08138***	4.89	2	1,010	.06593***	2.92	5	458
Pub Admin, Educ	.0647***	6.16	5	1,622	.09355***	10.98	2	2,110
Other Services	.07454**	2.21	4	220	.06092*	1.68	6	170

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (masters degree), disaggregated by industry; national baseline of individuals qualified to first degree level, disaggregated by industry; N. is the number of individuals qualified to masters degree level in each industry; R. is the rank of industry sectors in order of magnitude of return to masters degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.42

Returns to PhD Relative to Masters by Industry Sector

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Agric. & Fishing	.99582	0.88	-	5	-	-	-	3
Energy & Water	-.07665	0.82	-	23	.09339	0.32	-	6
Manufacturing	.11566***	3.46	1	191	-.00366	0.06	-	66
Construction	.07362	0.62	-	15	.28388*	1.75	1	3
Dist., Hotels & Rest	.02609	0.22	-	22	-.02077	0.13	-	10
Transport & Comm	.13351	1.09	-	20	-.01455	0.05	-	4
Banking & Finance	-.06526*	1.83	-	260	-.09084	1.63	-	90
Pub Admin, Educ	.03492**	2.09	2	817	.0365**	2.09	2	523
Other Services	-.00172	0.02	-	34	-.02997	0.33	-	28

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (PhD), disaggregated by industry; national baseline of individuals qualified to masters degree level, disaggregated by industry; N. is the number of individuals qualified to PhD level in each industry; R. is the rank of industry sectors in order of magnitude of return to PhD; (-) denotes an insignificant or negative return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.43

Returns Relative to A Level by Industry Sector

	First Degree		Masters		PhD	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
Male						
Agriculture & Fishing	.03693	0.51	.10654	0.89	.40535**	2.34
Energy & Water	.28948***	9.58	.34487***	7.53	.35388***	4.50
Manufacturing	.25402***	25.65	.31579***	18.89	.44166***	16.58
Construction	.23507***	12.81	.2973***	8.41	.37931***	4.10
Distribution, Hotels & Rest.	.18657***	12.52	.32168***	11.26	.43103***	5.55
Transport & Comms.	.20124***	11.35	.30249***	9.73	.30817***	3.65
Banking, Finance & Ins.	.18194***	15.32	.2551***	14.58	.17095***	5.71
Pub Admin, Educ. & Health	.17375***	20.23	.2704***	21.84	.30568***	15.85
Other Services	.12811***	4.98	.22169***	6.27	.22966***	2.85
Female						
Agriculture & Fishing	.08422	0.88	.19647	1.27	.52649	1.30
Energy & Water	.24944***	4.69	.48711***	5.87	.69236***	4.32
Manufacturing	.26916***	13.74	.37617***	11.10	.39755***	7.26
Construction	.15756***	3.23	.38884***	4.31	.36252	1.31
Distribution, Hotels & Rest.	.15512***	9.90	.24062***	7.04	.23813**	2.02
Transport & Comms.	.20095***	7.18	.35561***	6.42	.3639*	1.75
Banking, Finance & Ins.	.17661***	13.92	.24021***	10.68	.12516***	2.79
Pub Admin, Educ. & Health	.22768***	35.20	.39215***	38.52	.43191***	23.31
Other Services	.18061***	7.70	.24186***	6.42	.18263**	2.29

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters or PhD), disaggregated by industry; national baseline of individuals qualified to A level, disaggregated by industry; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

industry which imposes an earnings penalty on possession of a PhD (relative to masters): banking, finance and insurance.

The negative premium at PhD level (relative to masters) for men in the banking, finance and insurance sector can be seen in table 5.43, as the premium (relative to A level) between masters and PhD level falls from .2551 to .17095. Manufacturing offered the largest male PhD premium relative to masters, and also offers the largest PhD premium when compared to A level holders. For women, the largest premiums at both masters and PhD levels are found in the energy and water sector, followed by the public administration, education and health sector.

Recent policy has placed an emphasis on the importance of STEM (science, technology, engineering and maths) to the economy. It is possible to look at graduates in these subjects and find out which industry they are employed in.[53] I find that the dominant employer of STEM graduates (combined across first degree, masters, PGCE and PhD) is the public administration, education and health sector, with 36% of STEM graduates. Including medicine and dentistry and medicine related graduates in my STEM definition causes this figure to jump to 59%. It may have been expected that manufacturing would be the next highest STEM employer, but that is not the case. Whilst manufacturing employs 19% of STEM graduates, 25% are employed in the banking, finance and insurance sector. With a sizable portion of STEM graduates moving out of STEM areas of work, it may suggest that the recent importance on STEM subjects may be somewhat misguided.[54] Table 5.44 calculates the premium paid to first degrees in STEM subjects relative to A levels by industrial sector. There is a significant rise in returns in the transport and communications industry for STEM graduates compared to all graduates. However, compared to all graduates, STEM graduates face a fall in returns if employed in the

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[53] I define STEM as biological sciences, veterinary and agricultural sciences, physical sciences, maths and computer science, engineering and technologies. Some definitions also include medicine and dentistry and medicine related subjects. I only include medicine and dentistry and medicine related subjects in our STEM definition when explicitly stated.

[54] Full figures are in table 5.A6 in the appendix.

Table 5.44

Returns to First Degree Relative to A level by Industry Sector (STEM Graduates)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Agric. & Fishing	.09793	1.19	-	46	.22893	1.53	-	19
Energy & Water	.26337***	8.05	1	306	.16744**	2.00	3	44
Manufacturing	.20671***	17.99	3	1,822	.21875***	7.25	2	61
Construction	.2014***	8.48	4	431	.06278	0.75	-	55
Dist., Hotels & Rest	.1708***	7.44	5	402	.11221***	3.57	6	183
Transport & Comm	.23745***	9.47	2	396	.26282***	4.70	1	82
Banking & Finance	.11352***	7.95	6	2,218	.14841***	6.88	4	641
Pub Admin, Educ	.08964***	8.10	8	2,233	.11912***	10.63	5	2,018
Other Services	.10109***	2.75	7	270	.0892**	2.10	7	141

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree) for STEM graduates, disaggregated by industry; national baseline of individuals qualified to A level, disaggregated by industry; N. is the number of individuals qualified to first degree level in each industry; R. is the rank of industry sectors in order of magnitude of return to first degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.45

Returns to First Degree Relative to A Level by Age Groups

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
25 – 34	.17304***	20.65	3	5,091	.17564***	22.08	3	6,078
35 – 49	.21954***	30.21	2	6,041	.24669***	32.49	1	6,075
50 – 64	.24318***	24.25	1	2,773	.23221***	19.04	2	2,344
25 – 29	.13347***	11.33	8	2,475	.14891***	14.57	7	3,208
30 – 34	.21045***	17.76	5	2,616	.19657***	15.80	6	2,870
35 – 39	.19474***	16.06	7	2,416	.24232***	18.88	3	2,227
40 – 44	.21441***	17.20	4	1,965	.23756***	18.34	4	2,149
45 – 49	.25338***	18.88	1	1,660	.25787***	18.65	2	1,699
50 – 54	.24864***	17.38	3	1,371	.2286***	13.72	5	1,318
55 – 59	.24876***	14.97	2	1,049	.27283***	13.85	1	814
60 – 64	.20508***	7.59	6	353	.13227***	3.06	8	212

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by age group; national baseline of individuals qualified to A level, disaggregated by age group; N. is the number of individuals qualified to first degree level in each age group; R. is the rank of age groups in order of magnitude of return to first degree; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

manufacturing sector. 25% of STEM graduates were found to be employed in the banking, finance and insurance sector, however, returns to STEM graduates in this sector are lower than for all graduates (.18194 to .11352 for men, and .17661 to .14841 for women). The premium in the banking, finance and insurance sector is healthier for business administration and economics graduates (.16787 and .16979 for business administration, and .30239 and .27584 for economics), suggesting that a university education in these fields (especially economics) better prepares graduates for employment in the banking, finance and insurance sector. The inclusion of medicine and dentistry and medicine related subjects in the STEM definition does little to change these results (table 5.A8).

Age Groups

Previous research (McIntosh, 2002) has shown the graduate premium to vary across age groups. Whilst I have not conducted a cohort analysis, it is likely that the majority of first degree holders will have enrolled on their (first) degree course immediately after leaving school or soon after, so age should be a fair estimate of the time a degree was obtained. Ages are grouped into three broad classifications and also into narrower bands.

The graduate premium by age is presented in table 5.45. Results show the graduate premium to be significant for all age groups. Focusing on the broad age bands first, it shows the male graduate premium to increase with age, with a large difference between those aged 25 to 34 (.17304) and those aged 35 to 49 (.21954). This large gap in the earnings premium between the youngest age groups is also seen for women (.17564 to .24669), but the graduate premium declines slightly for the 50 to 64 age group (.23221). Narrower bands show that the difference between the youngest group (25 to 29) and the second youngest group (30 to 34) is large (.13347 to .21045 for men and .14891 to .19657 for women). Similar results have been found by McIntosh (2002), with a large increase in gains up to individuals' early thirties. McIntosh uses a pseudo-cohort analysis, which means his result is due to age or time effects. These results may be due to an age effect, where earnings increase with age and graduates require a certain amount of time and experience to find employment that sufficiently compensates them for their educational attainment, or it may be a cohort effect, where due to the rapid increases in student numbers, more recent graduates find that their degrees are in less demand and are they are less valued than previous graduates. This may be due to recent demand falling behind the supply of graduates or due to quality issues, where the increase in student numbers has lowered the quality of a degree through factors such as increased pressure on teaching resources and a lowering of the quality of the marginal student entering university (Chevalier, 2003 and Walker and Zhu, 2008). The male graduate premium peaks in the 45 to 49 year age range, followed by the 55 to 59 and 50 to 54 year age groups. For women, the largest returns are found in the 55 to 59 year age group, but fall to their lowest level in the 60 to 64 year age group (.27283 to .13227).

At masters level, partially due to the large male earnings in the 50 to 64 year age group, the order of magnitude for the large age bands is reversed, with the masters premium decreasing with age (table 5.46). For women, there is a large rise between the 25 to 34 and 35 to 49 year age groups. Switching to narrow age bands, the low female masters premium for the young is caused by an insignificant masters premium in the 25 to 29 year age group. The largest female masters premium is found in the 60 to 64 year age group, which contrasts with the male premium in this age group, which is insignificant. Low returns are found for men in the 50 to 59 year age group, which helps explain why the male masters premium declines with age in the broad age bands.

At an aggregated level, the PhD premium relative to masters was found to be insignificant. By splitting the sample into three age groups, a PhD premium is found only in the 50 to 64 year age group (table 5.47). The magnitude of this return is greater for women than men (.06962 to .04608). Investigation of the narrower age bands reveals that this effect is driven by those in the 50 to 54 year age group. The only other narrow age band that displays significant returns to possession of a PhD relative to masters is the 40 to 44 year age group, for men.

Table 5.46

Returns to Masters Relative to First Degree by Age Groups

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
25 – 34	$.06908^{***}$	5.58	1	1,171	$.03937^{***}$	3.22	3	1,051
35 – 49	$.06857^{***}$	6.01	2	1,832	$.0939^{***}$	8.13	2	1,478
50 – 64	$.04842^{***}$	2.93	3	1,004	$.09734^{***}$	5.40	1	658
25 – 29	$.06375^{***}$	3.73	4	524	.01818	1.14	-	505
30 – 34	$.07676^{***}$	4.32	2	647	$.05133^{***}$	2.75	7	546
35 – 39	$.07337^{***}$	3.94	3	669	$.0943^{***}$	4.93	4	550
40 – 44	$.05856^{***}$	2.97	5	630	$.09201^{***}$	4.36	5	498
45 – 49	$.07717^{***}$	3.59	1	533	$.09465^{***}$	4.84	3	430
50 – 54	$.05344^{**}$	2.26	6	472	$.10947^{***}$	4.54	2	339
55 – 59	$.0433^{*}$	1.65	7	383	$.076^{***}$	2.66	6	259
60 – 64	.05387	1.05	-	149	$.13766^{*}$	1.71	1	60

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (masters degree), disaggregated by age group; national baseline of individuals qualified to first degree level, disaggregated by age group; N. is the number of individuals qualified to masters degree level in each age group; R. is the rank of age groups in order of magnitude of return to masters degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.47

Returns to PhD Relative to Masters by Age Groups

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
25 – 34	-.01942	0.73	-	278	-.00875	0.33	-	236
35 – 49	.02122	1.02	-	662	.00244	0.10	-	350
50 – 64	$.04608^{*}$	1.76	1	448	$.06962^{*}$	1.80	1	147
25 – 29	.04298	0.98	-	79	-.00187	0.05	-	97
30 – 34	-.03649	1.07	-	199	-.02156	0.59	-	139
35 – 39	.02939	0.87	-	241	-.04156	1.10	-	121
40 – 44	$.06848^{*}$	1.90	1	243	.04165	0.98	-	135
45 – 49	-.03419	0.84	-	178	-.00076	0.02	-	94
50 – 54	$.06554^{*}$	1.76	2	207	$.10964^{**}$	2.03	1	73
55 – 59	.03273	0.75	-	166	.10625	1.63	-	51
60 – 64	-.00226	0.03	-	75	.03382	0.24	-	23

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (PhD), disaggregated by age group; national baseline of individuals qualified to masters degree level, disaggregated by age group; N. is the number of individuals qualified to PhD level in each age group; R. is the rank of age groups in order of magnitude of return to PhD; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Relative to A level holders, at both masters and PhD levels, returns are found to increase with age in the broad age bands (table 5.48). This fits with the prior result of a PhD premium only being found in the 50 to 64 year age band. Focusing on the narrow age bands, the largest higher degree premiums are found towards the upper parts of the age distribution. For both men and women, the largest masters premium is found in the 45 to 49 year age group, followed by the 50 to 54 and 55 to 59 year age groups. At PhD level, the greatest return is observed for those aged 50 to 54.

Employment Sector

It is likely that the public and private sectors will place different values on degree qualifications and that there will be even more variation across these employment sectors when region, subject area, industrial sector and age group are considered. The following estimations explore this theory.

Table 5.49 reveals there to be differences in the returns to first degrees (relative to A levels) across sectors and genders. Men find their first degrees to be more highly valued in the private sector, whilst for women the opposite result is found: their graduate premium is greatest in the public sector (McIntosh (2002) also reported that the private sector offers a larger graduate premium for men, than the public sector). Analysis across the earnings distribution would shed more light on this result (this is seen in table 5.54). This pattern holds at masters degree level; the rewards to masters degrees relative to first degrees are largest in the public sector for women (.09216 to .07242) and the private sector for men (.07051 to .06713). Going further, I find the PhD premium (relative to masters) to exist only in the public sector. These premiums are small: .03547 for men and .03199 for women (70% of female PhD holders in the sample work in the public sector, whilst the public sector employs close to 60% of male PhD holders). As with previous region based estimates, the graduate premium is calculated relative to both within region and national baselines of A level holders.

Table 5.48

Returns Relative to A Level by Age Groups

	First Degree		Masters		PhD	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
Male						
25 – 34	.17304***	20.65	.25885***	19.27	.264***	10.63
35 – 49	.21954***	30.21	.30583***	27.98	.32147***	18.11
50 – 64	.24318***	24.25	.32371***	21.90	.36912***	17.48
25 – 29	.13347***	11.33	.22462***	11.59	.2623***	6.02
30 – 34	.21045***	17.76	.28658***	15.46	.25575***	8.31
35 – 39	.19474***	16.06	.28951***	15.77	.30337***	10.21
40 – 44	.21441***	17.20	.28208***	15.21	.34644***	11.82
45 – 49	.25338***	18.88	.34786***	17.19	.3057***	8.97
50 – 54	.24864***	17.38	.33298***	15.62	.3904***	12.55
55 – 59	.24876***	14.97	.32411***	13.16	.37075***	10.54
60 – 64	.20508***	7.59	.30635***	8.08	.33438***	6.53
Female						
25 – 34	.17564***	22.08	.25283***	17.78	.25467***	8.88
35 – 49	.24669***	32.49	.38438***	31.45	.39632***	17.09
50 – 64	.23221***	19.04	.40161***	20.62	.43764***	12.23
25 – 29	.14891***	14.57	.1859***	10.07	.19588***	4.75
30 – 34	.19657***	15.80	.31087***	14.23	.27946***	6.93
35 – 39	.24232***	18.88	.37883***	19.08	.34305***	8.65
40 – 44	.23756***	18.34	.35521***	16.48	.44473***	11.35
45 – 49	.25787***	18.65	.42132***	18.63	.39592***	9.23
50 – 54	.2286***	13.72	.41866***	15.65	.50093***	10.03
55 – 59	.27283***	13.85	.39046***	12.34	.43225***	7.37
60 – 64	.13227***	3.06	.34156***	4.99	.23803**	2.12

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters degree or PhD), disaggregated by age group; national baseline of individuals qualified to A level, disaggregated by age group; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.49

Returns by Public/Private Sector

	Male				Female			
	Public		Private		Public		Private	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
First Deg.	.1738***	20.92	.2153***	37.22	.22134***	32.28	.2081***	29.08
Masters	.06713***	6.39	.07051***	6.98	.09216***	10.51	.07242***	5.36
PhD	.03547**	2.12	.02077	0.94	.03199*	1.85	.00247	0.07

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters degree or PhD), disaggregated by employment sector; national baseline of individuals qualified to A level, first degree or masters level, disaggregated by employment sector; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.50 reveals that, for women, only the South East and South West have greater graduate premiums in the private sector than the public sector. All other regions display the general result where the female earnings premium is greater in the public sector. The large private sector earnings in the South Eastern regions drive the private sector graduate premium up so that the returns for women are greater in the private sector for both the South East and London when using a national baseline (table 5.51). For men, the opposite general result is found, that the graduate premium is greater in the private sector. However, there are two exceptions using a regional baseline (London and the South West) and five exceptions using a national baseline. Using a regional baseline, the East Midlands and West Midlands show high public sector returns, whilst high private sector returns are found in Scotland and the North West.

The public/private sector split is extended to twenty subject areas at first degree level (table 5.52). There appears to be great differences across sectors for men and women: thirteen of the twenty subject areas have their largest graduate premium in different sectors for men and women, which is in line with the result found in table 5.49. Some of the larger differences include linguistics and classics in the public sector, where men have a graduate premium of just .05523 compared to .25052 for women; mass communications in the private sector, where men have an earnings advantage of just .06072 compared to .14208 for women; and history and philosophy, where the public sector rate of return for women is .21816, far above the male figure of .07738 and the private sector figure for men is .08993, far below the premium of .17415 for women. There are also many within gender differences between sectors, particularly for men with linguistics and classics and medicine related degrees, women with first degrees in veterinary and agricultural studies, and for both men and women with education based degrees. Whilst premiums were found for all subject areas prior to splitting by employment sector, in the public sector, no premium is found for men with first degrees in mass communications, and returns are also insignificant for male private sector arts graduates.

Table 5.50

Returns to First Degree Relative to A level by Region and Public/Private Sector (Regional Baseline)

	Male				Female			
	Public		Private		Public		Private	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
East	.11681***	3.16	.18259***	7.58	.18313***	5.90	.15711***	5.33
East Midlands	.20373***	5.34	.20771***	8.71	.29535***	9.88	.19565***	6.59
London	.16903***	6.35	.16119***	9.50	.18053***	7.11	.14983***	6.92
North East	.18071***	5.49	.18998***	8.11	.19988***	7.71	.17672***	6.31
North West	.16802***	6.67	.21813***	13.27	.24792***	13.07	.19179***	9.32
North. Ireland	.24049***	4.55	.25166***	5.44	.20258***	4.62	.12948**	2.21
Scotland	.18999***	9.79	.22231***	14.31	.22227***	13.68	.20178***	11.76
South East	.13397***	5.20	.21028***	13.37	.16069***	7.51	.18114***	9.70
South West	.18213***	6.43	.17538***	8.86	.18508***	7.21	.19088***	7.81
Wales	.1457***	5.40	.20222***	9.14	.16737***	7.81	.1239***	4.81
West Midlands	.1901***	5.76	.19292***	9.64	.26498***	10.19	.20911***	7.64
Yorkshire	.13637***	4.70	.20778***	10.85	.27722***	11.52	.18667***	7.34

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by region and employment sector; regional baseline of individuals qualified to A level, disaggregated by employment sector; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.51

Returns to First Degree Relative to A level by Region and Public/Private Sector (National Baseline)

	Male				Female			
	Public		Private		Public		Private	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
East	.16628***	7.24	.21567***	12.98	.24358***	14.91	.21433***	10.88
East Midlands	.14289***	6.50	.15105***	8.89	.25173***	14.89	.14232***	6.65
London	.35943***	22.78	.40954***	38.93	.40278***	29.76	.44002***	34.92
North East	.16937***	8.39	.08404***	4.38	.2356***	15.19	.06326***	2.79
North West	.14907***	8.77	.15093***	12.14	.23969***	19.69	.14885***	9.19
North. Ireland	.13918***	4.60	.10162***	3.03	.22121***	9.92	.07579**	2.18
Scotland	.19564***	13.55	.17135***	14.10	.27267***	25.03	.15513***	10.78
South East	.16159***	9.79	.28828***	26.67	.23818***	18.46	.27097***	20.24
South West	.17464***	9.49	.12639***	8.79	.22094***	15.03	.14295***	8.27
Wales	.12063***	7.29	.08529***	5.19	.20337***	15.40	.07362***	3.88
West Midlands	.12811***	6.63	.1516***	9.94	.25688***	16.91	.16451***	8.52
Yorkshire	.14193***	7.68	.14272***	9.43	.24999***	17.37	.12096***	6.37

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by region and employment sector; national baseline of individuals qualified to A level, disaggregated by employment sector; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.52

Returns to First Degree Relative to A level by Subject Area and Public/Private Sector

	Male				Female			
	Public		Private		Public		Private	
	Coeff.	**t stat**	**Coeff.**	**t stat**	**Coeff.**	**t stat**	**Coeff.**	**t stat**
Medicine & Dent.	.52523***	15.95	.43405***	5.20	.59109***	22.47	.46928***	5.42
Medicine Related	.16238***	6.95	.30852***	8.67	.29144***	25.29	.39115***	16.56
Biological Sci.	.12985***	6.57	.14947***	7.36	.20667***	13.01	.17936***	9.76
Veterinary & Agric	.15229***	2.93	.18570***	5.11	.1609***	3.43	.09639**	2.43
Physical Sciences	.18327***	9.52	.21283***	15.02	.2224***	9.77	.21723***	8.50
Maths & Comp Sci	.16614***	8.32	.24984***	18.26	.31714***	13.51	.20676***	7.89
Engineering	.21198***	11.05	.25354***	24.96	.32502***	6.45	.26243***	7.07
Technologies	.16112***	2.98	.13699***	3.97	.15255***	2.61	.18149***	3.30
Architecture	.17672***	5.95	.22442***	11.12	.26668***	6.35	.19758***	4.77
Economics	.25872***	7.95	.32944***	14.42	.3653***	8.97	.29496***	8.30
Politics	.18413***	5.05	.23633***	5.94	.281***	7.54	.25908***	5.07
Other Social Sci.	.20318***	9.61	.181***	7.70	.25312***	18.23	.18832***	9.78
Law	.25979***	9.28	.30722***	13.49	.33537***	13.34	.27721***	12.18
Business Admin.	.19346***	10.05	.22812***	18.39	.19241***	11.57	.22032***	16.39
Mass Comms.	.05432	1.15	.06072*	1.69	.16437***	5.52	.14208***	4.40
Ling. & Classics	.05523*	1.84	.17757***	5.44	.25052***	13.13	.22975***	10.15
Language & Lit.	.17791***	4.64	.21969***	5.81	.18635***	7.50	.27783***	10.27
History & Phil.	.07738***	3.69	.08993***	4.08	.21816***	11.42	.17415***	7.29
Arts	.1202***	4.99	.0239	1.22	.21306***	11.50	.11789***	6.30
Education	.24479***	10.54	.07754*	1.80	.32678***	21.42	.11503***	4.11

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by subject area and employment sector; national baseline of individuals qualified to A level, disaggregated by subject area and employment sector; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

I previously found there to be great differences in the graduate premium across the age profile (table 5.48), and these differences are amplified by splitting the employment sector. For men in the private sector, the graduate premium quickly climbs to .2291 by the 30 to 34 age group, before peaking at .27222 in the 45 to 49 year age group (table 5.53). In the public sector, the male earnings premium climbs far slower, peaking at .24633 for the age group 55 to 59. This is likely a consequence of promotion in many public sector jobs being more tenure dependant than those in the private sector. However, for women, the public sector graduate premium is always higher than for men (except in the over 60 group), reflecting the greater earnings advantage a first degree provides women. The graduate premium still peaks in the 55 to 59 year age range (.28268), as for men, and rises steadily before this period (disregarding a spike in the premium in the 35 to 39 year age group). Private sector earnings for women peak in the 45 to 49 year age group, as with men.

Quantile Regression Results

It is likely that the graduate premium will differ across the earnings distribution. Walker and Zhu (2010) suggest that quantile regressions can be used to control for unobserved skills. They suggest two possible cases: where unobserved skills are correlated with observed skills, such as attainment of a qualification, the largest returns would be expected at the top of the earnings distribution, and alternatively, where low unobserved skills cause an increase in effort, placing the largest returns at the bottom of the earnings distribution. Table 5.54 presents results at three points on the earnings distribution: the 25th percentile, the median and the 75th percentile.

Initial results reveal that the graduate premium increases along the earnings distribution, although the changes are relatively small (table 5.54). Whilst I have shown women to benefit more from the possession of a first degree, at lower levels of the earnings distribution it is men who benefit more (although the difference is insignificant). For masters degrees relative to first degrees, both men and women see very little difference across the earnings distribution, however, at PhD level,

Table 5.53

Returns to First Degree Relative to A Level by Age Groups and Public/Private Sector

	Male				Female			
	Public		Private		Public		Private	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
25 – 34	.11862***	7.33	.18626***	19.31	.19363***	15.13	.16473***	16.33
35 – 49	.17891***	15.11	.23759***	26.84	.22994***	24.13	.26049***	22.16
50 – 64	.22265***	13.14	.24316***	19.46	.25367***	16.36	.20401***	10.49
25 – 29	.09875***	3.95	.14083***	10.52	.16536***	9.07	.14255***	11.54
30 – 34	.14261***	6.54	.2291***	16.66	.2169***	11.93	.18287***	10.99
35 – 39	.17098***	8.43	.20493***	14.07	.24111***	14.49	.24114***	12.78
40 – 44	.13707***	6.61	.24425***	16.18	.21576***	13.35	.26024***	12.77
45 – 49	.21997***	10.47	.27222***	16.23	.23183***	13.62	.28158***	12.38
50 – 54	.21229***	8.97	.25464***	14.27	.25113***	11.83	.20124***	7.52
55 – 59	.24633***	8.93	.23971***	11.41	.28268***	11.61	.24676***	7.59
60 – 64	.17175***	3.34	.21262***	6.47	.14928**	2.42	.10564*	1.65

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by age group and employment sector; national baseline of individuals qualified to A level, disaggregated by age group and employment sector; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.54

Returns by Quantile Regression

	0.25		0.5		0.75	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
First Degree						
Male	.19115***	35.83	.21109***	42.46	.2234***	36.51
Female	.18821***	28.77	.21925***	40.59	.22678***	36.65
Masters						
Male	.06417***	7.39	.06355***	7.20	.05296***	5.67
Female	.07891***	8.87	.07247***	9.58	.08631***	10.33
PhD						
Male	.01149	0.72	.02027	1.48	.05316***	3.15
Female	-.00033	0.02	.00451	0.23	.03768*	1.71

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters degree or PhD); national baseline of individuals qualified to A level, first degree or masters level; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

differences are apparent. A PhD premium (relative to masters) for both men and women is only identified in the upper quartile. I look at how the graduate premium varies across the earnings distribution when disaggregated by region, subject, employment sector, industry sector and age groups. While these results do have some variation, applying the theory of Walker and Zhu (2010), results suggest that unobserved skills complement observed skills, as returns tend to rise along the earnings distribution.[55]

Table 5.55 gives the within region graduate premium at three points in the earnings distribution for men and women. Around half the regions follow the pattern of increasing rates of return along the earnings distribution; the remainder deviate from this pattern. It should be noted that these differences in the graduate premium between points in the earnings distribution are generally small, as they are for the sample as a whole. Women in the East Midlands were found to have the largest within region graduate premium (table 5.26); this can be seen to be driven by those in the upper parts of the earnings distribution (.29255). The graduate premium for women in the East Midlands shows the largest increases along the earnings distribution.

Whilst there is variation at the regional level, there is even greater variation in the graduate premium between subject areas (table 5.56). Eleven subject areas for men break from the expected result of an increasing graduate premium along the earnings distribution, whilst only two subjects see increases along the earnings distribution for women. In fact, in three subject areas for men (maths and computer science, engineering and architecture), the graduate premium falls along the earnings distribution. Five subject areas for women (medicine related, politics, social sciences, education and architecture) exhibit this same trait. No earnings advantage is found for male mass communications degree holders in the upper part of the earnings distribution. Many subject areas for women show a fall between the

[55] Due to sample size limitations, I do not carry out disaggregated quantile regressions with higher degrees, but focus only on the premiums paid to first degrees.

Table 5.55

Returns to First Degree Relative to A Level across the Earnings Distribution by Region

	0.25		0.5		0.75	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
Male						
East	.15525***	5.86	.16691***	7.07	.20065***	7.91
East Midlands	.19395***	9.65	.2269***	9.39	.22052***	6.96
London	.17293***	9.84	.16439***	11.27	.17642***	9.25
North East	.19613***	9.06	.18343***	8.51	.20683***	8.67
North West	.1847***	11.08	.20729***	13.16	.21313***	10.57
North. Ireland	.21742***	5.59	.19044***	4.76	.23731***	8.65
Scotland	.20244***	12.34	.2205***	17.39	.22368***	17.05
South East	.18171***	12.21	.19149***	12.68	.20833***	13.21
South West	.16607***	8.77	.18007***	12.38	.18167***	10.00
Wales	.14791***	7.76	.20531***	13.26	.18223***	8.10
West Midlands	.16767***	7.89	.18662***	9.24	.21961***	9.72
Yorkshire	.16527***	8.24	.19258***	11.08	.1993***	8.92
Female						
East	.14286***	5.04	.18323***	7.44	.1562***	8.18
East Midlands	.18202***	7.55	.23665***	11.90	.29255***	14.74
London	.1627***	9.38	.15554***	10.26	.1652***	7.10
North East	.19407***	8.71	.21961***	11.86	.19237***	10.00
North West	.2001***	11.04	.20592***	16.78	.224***	15.54
North. Ireland	.17697**	2.48	.17295***	3.73	.21034***	3.85
Scotland	.18846***	12.65	.21439***	18.60	.22212***	14.93
South East	.14659***	10.31	.16549***	10.96	.15624***	9.41
South West	.14723***	7.16	.21314***	11.08	.2011***	9.15
Wales	.13081***	7.50	.14579***	10.85	.17082***	9.30
West Midlands	.24493***	12.03	.23752***	11.49	.25498***	10.73
Yorkshire	.17859***	11.23	.21686***	13.35	.26356***	10.36

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by region; national baseline of individuals qualified to A level; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.56

Returns to First Degree Relative to A Level across the Earnings Distribution by Subject Area

	0.25		0.5		0.75	
	Coeff.	**t stat**	**Coeff.**	**t stat**	**Coeff.**	**t stat**
Male						
Medicine & Dentistry	.50615***	12.78	.5026***	15.23	.60237***	15.18
Medicine Related	.15224***	5.86	.18791***	8.00	.23328***	9.05
Biological Sciences	.09648***	5.40	.14825***	9.04	.1436***	7.89
Veterinary & Agric.	.16038***	4.12	.1525***	4.77	.17323***	4.66
Physical Sciences	.20022***	13.78	.21234***	15.63	.20332***	14.36
Maths & Comp. Sci.	.24087***	16.79	.23834***	18.76	.22352***	15.71
Engineering	.26889***	25.33	.25743***	26.89	.24029***	22.10
Technologies	.14775***	4.01	.16171***	5.16	.1704***	4.68
Architecture	.23779***	11.15	.19957***	10.96	.16084***	7.95
Economics	.29417***	12.43	.33126***	15.85	.32199***	13.93
Politics	.15167***	4.36	.20813***	6.92	.30906***	8.33
Other Social Sciences	.16837***	8.20	.2038***	11.11	.20876***	10.90
Law	.24451***	11.47	.28423***	14.21	.32169***	15.04
Business Admin.	.19403***	17.36	.2271***	18.83	.26463***	21.00
Mass Comms.	.08496**	2.42	.07307**	2.31	.037	1.02
Linguistics & Classics	.08981***	3.16	.13155***	5.07	.19046***	6.63
Language & Lit.	.14141***	3.87	.2771***	9.21	.23231***	6.47
History & Philosophy	.03333*	1.73	.11004***	6.18	.12766***	6.09
Arts	.04496**	2.48	.07517***	4.40	.09803***	5.20
Education	.24837***	9.14	.27507***	12.51	.23589***	9.70
Female						
Medicine & Dentistry	.48648***	17.94	.51773***	18.69	.54335***	17.02
Medicine Related	.34739***	30.26	.31102***	26.96	.26064***	19.78
Biological Sciences	.1733***	13.19	.19848***	14.76	.18734***	11.85
Veterinary & Agric.	.10926***	3.42	.11079***	3.78	.08501**	2.44
Physical Sciences	.18968***	11.21	.23632***	13.36	.22808***	9.46
Maths & Comp. Sci.	.25653***	13.99	.30598***	18.49	.26506***	11.72
Engineering	.31284***	10.65	.3255***	12.71	.29327***	8.14
Technologies	.16345***	4.04	.17647***	4.60	.11805**	2.57
Architecture	.31446***	10.51	.25171***	8.75	.12781***	3.62
Economics	.33256***	12.04	.35355***	14.07	.30245***	9.74
Politics	.27201***	8.41	.27037***	9.13	.26301***	6.91
Other Social Sciences	.23572***	17.88	.23314***	19.57	.19251***	12.94
Law	.24905***	13.88	.31258***	18.88	.33036***	14.96
Business Admin.	.17512***	17.14	.21802***	18.59	.21749***	15.91
Mass Comms.	.13916***	6.41	.13507***	6.39	.14639***	5.75
Linguistics & Classics	.19576***	12.69	.26644***	17.41	.25366***	13.80
Language & Lit.	.21768***	11.22	.23906***	13.01	.21978***	9.06
History & Philosophy	.14489***	8.98	.21582***	13.31	.21079***	10.85
Arts	.13198***	9.29	.15942***	12.28	.15745***	9.61
Education	.2878***	17.47	.2726***	19.86	.2575***	15.63

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by subject area; national baseline of individuals qualified to A level; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

median and the 75th percentile, although for many subject areas this difference is small.

The graduate premium for industry sectors across the earnings distribution is shown in table 5.57. Whilst several industry sectors do not follow the expected pattern of a rising graduate premium, the deviations are generally small. Large increases in the graduate premium along the earnings distribution are found in the distribution, hotels and restaurants industry, increasing from .10774 to .25406 for men and .09085 to .17503 for women. Large increases are also observed between the 25th percentile and the median in the construction industry for women (.10191 to .20913). Energy and water provided the second largest graduate premium for women (table 5.40), but quantile regression reveals there to be no return to holding a degree in the lower portions of the earnings distribution.

Quantile regression analysis has also been carried out by employment sector (table 5.58). Whilst results for both men and women, in both the public and private sectors, show an increasing graduate premium along the earnings distribution (apart from an insignificant fall for public sector females at the top of the earnings distribution), there are differences between the sectors. The graduate premium in the public sector is relatively stable, showing small increases along the earnings distribution, however, there are larger differences between the 25th and 75th percentiles in the private sector suggesting degree holders in the private sector have a greater earnings advantage than those in the public sector if they can rise up the earnings distribution.

Male results by age group vary little from the full sample (table 5.59). Most derivations from rises across the earnings distribution are minor differences. A large increase is also seen in the earnings premium between the 25th percentile and the median for several age bands, such as males aged 60 to 64, and females aged 35 to 39, 50 to 54 and 55 to 59. The 60 to 64 year age group shows a large fall between the median and the 75th percentile (.16045 to .10688).

Table 5.57

Returns to First Degree Relative to A Level across the Earnings Distribution by Industry Sector

	0.25		0.5		0.75	
	Coeff.	**t stat**	**Coeff.**	**t stat**	**Coeff.**	**t stat**
Male						
Agriculture & Fishing	.02459	0.24	-.01509	0.18	.10389	1.11
Energy & Water	.27795***	7.25	.23594***	7.32	.30153***	8.74
Manufacturing	.24787***	17.76	.25448***	23.17	.25922***	21.44
Construction	.2334***	11.16	.23809***	10.27	.23074***	10.11
Distribution, Hotels & Rest.	.10774***	6.26	.18324***	10.48	.25406***	13.73
Transport & Comms.	.17503***	9.16	.20744***	11.96	.20845***	8.95
Banking, Finance & Ins.	.18085***	12.94	.18877***	14.31	.20498***	11.63
Pub Admin, Educ. & Health	.14814***	12.01	.16698***	18.47	.17893***	17.70
Other Services	.13552***	4.90	.15609***	5.66	.1347***	4.26
Female						
Agriculture & Fishing	.01108***	9.65	-	-	.19919	1.43
Energy & Water	.1454	1.28	.27598***	2.93	.33802***	8.75
Manufacturing	.2447***	11.08	.24364***	10.23	.2627***	9.45
Construction	.10191**	2.44	.20913***	7.67	.21129***	4.23
Distribution, Hotels & Rest.	.09085***	5.92	.14155***	9.56	.17503***	10.44
Transport & Comms.	.21837***	9.77	.19467***	6.71	.18888***	5.29
Banking, Finance & Ins.	.13574***	10.40	.19788***	14.53	.21614***	13.15
Pub Admin, Educ. & Health	.21374***	26.63	.22195***	32.69	.21786***	32.03
Other Services	.15795***	5.64	.15994***	6.08	.17441***	5.75

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by industry; national baseline of individuals qualified to A level, disaggregated by industry; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.58

Returns to First Degree Relative to A Level across the Earnings Distribution by Public/Private Sector

	0.25		0.5		0.75	
	Coeff.	**t stat**	**Coeff.**	**t stat**	**Coeff.**	**t stat**
Male						
Public	.15348***	14.62	.1664***	21.49	.17078***	16.67
Private	.2099***	31.90	.22685***	38.06	.24226***	32.01
Female						
Public	.20312***	25.21	.21627***	29.97	.21363***	29.62
Private	.17784***	21.59	.2187***	30.43	.23233***	25.60

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by employment sector; national baseline of individuals qualified to A level, disaggregated by employment sector; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.59

Returns to First Degree Relative to A Level across the Earnings Distribution by Age Groups

	0.25		0.5		0.75	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
Male						
25 – 34	.15732***	14.38	.16643***	16.42	.18434***	15.73
35 – 49	.20976***	23.29	.22813***	29.57	.24329***	27.78
50 – 64	.23335***	20.34	.27017***	26.53	.27751***	21.77
25 – 29	.12943***	9.18	.12623***	9.41	.1307***	8.84
30 – 34	.19684***	11.70	.19936***	17.34	.23527***	15.68
35 – 39	.17824***	10.78	.19568***	13.74	.2301***	16.07
40 – 44	.20244***	11.72	.21871***	16.60	.2134***	12.22
45 – 49	.26212***	15.77	.26698***	18.21	.27646***	16.35
50 – 54	.249***	15.56	.28275***	17.38	.27008***	15.93
55 – 59	.23545***	12.98	.25615***	13.67	.28775***	16.08
60 – 64	.1441***	4.00	.24515***	11.42	.26303***	9.07
Female						
25 – 34	.15816***	18.50	.18195***	26.15	.18384***	19.59
35 – 49	.21356***	26.67	.25405***	33.94	.25434***	31.10
50 – 64	.19924***	13.53	.23149***	19.97	.24786***	15.71
25 – 29	.12321***	9.68	.1408***	13.48	.15403***	11.68
30 – 34	.18967***	13.38	.21109***	17.17	.21317***	12.03
35 – 39	.20368***	13.69	.25267***	19.56	.24913***	18.43
40 – 44	.20998***	14.66	.2484***	19.23	.2542***	24.55
45 – 49	.23622***	13.04	.25484***	17.77	.24857***	15.72
50 – 54	.18652***	8.57	.22018***	13.68	.23653***	11.14
55 – 59	.21646***	9.46	.27321***	15.35	.30402***	11.64
60 – 64	.13451**	2.22	.16045***	4.65	.10688**	2.52

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by age group; national baseline of individuals qualified to A level, disaggregated by age group; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Overall, the quantile regression estimates show that whilst there are some deviations from the expected result (an increase in the earnings premium along the earnings distribution), most of these deviations are minor and insignificant.

Sub-Regional Analysis: Wales

As I have decided to present Wales as a special case and go down to greater levels of disaggregation, I take a closer look at the within region graduate earnings premium in Wales, by subject (table 5.60). I also examine the graduate premium within Wales disaggregated by subject area, industrial sector, employment sector and age groups, and will compare these results to figures for the UK as a whole.

As would be expected, the greatest first degree earnings premium relative to A level is enjoyed by those with first degrees in medicine and dentistry (.607 for men and .54482 for women), with a magnitude larger than for the UK as a whole. After medicine and dentistry, men find their largest earnings mark-up with first degrees in education (.31609) and economics (.29983), with economics exceeding the UK average by several percentage points. For Welsh women, their largest earnings premiums after medicine and dentistry are found in the subject areas of technologies (.3771) and engineering (.34187), both of which are larger than the UK level premiums, with the Welsh premium for technologies more than doubling the UK figure. This contrasts with the male effect for holding a technologies degree, which is insignificant. Several other subjects fail to offer an earnings advantage over A level holders within Wales, namely mass communications, linguistics and classics, language and literature and history and philosophy for men, and veterinary and agricultural studies, architecture and mass communications for women.

Table 5.61 splits Wales into 22 unitary authorities according to workplace and estimates the graduate premium relative to A level holders working within that unitary authority. Results for men reveal that possession of a first degree provides a significant earnings advantage over A levels in every unitary authority except

Table 5.60

Returns to First Degree Relative to A level by Subject Area (Wales Only)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Medicine & Dent.	.607***	5.71	1	12	.54482***	5.64	1	15
Medicine Related	.23634***	3.57	7	29	.28113***	8.66	6	145
Biological Sci.	.19724***	3.99	9	52	.11444***	2.67	17	62
Vet. & Agric.	.1798**	2.52	11	24	.08789	0.98	-	14
Physical Sciences	.18605***	4.50	10	79	.21915***	3.95	8	38
Maths & Comp	.12103***	2.66	14	70	.268***	3.82	7	22
Engineering	.24685***	7.63	6	145	.34187***	3.10	3	9
Technologies	-.11732	1.18	-	12	.3771***	2.66	2	5
Architecture	.27792***	5.39	5	53	.12392	0.95	-	6
Economics	.29983***	4.08	3	23	.33429***	3.54	4	12
Politics	.29927***	2.60	4	9	.15904*	1.65	11	11
Social Studies	.15701***	2.82	13	41	.14198***	3.53	14	75
Law	.2147***	3.31	8	32	.29735***	5.06	5	34
Business Admin.	.16311***	4.26	12	91	.14322***	4.15	13	101
Mass Comms.	.25787	1.30	-	3	.12697	1.41	-	13
Ling. & Classics	.12747	1.42	-	15	.16591***	3.43	10	52
Language & Lit	-.09526	0.86	-	10	.12203*	1.80	16	23
History & Phil.	-.00386	0.07	-	49	.14351***	2.89	12	50
Arts	.11908**	2.35	15	50	.13443***	3.29	15	71
Education	.31609***	5.53	2	49	.17185***	4.04	9	153

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by subject area; national (Wales) baseline of individuals qualified to A level; N. is the number of individuals qualified to first degree level in each subject area; R. is the rank of subject areas in order of magnitude of return to first degree; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.61

Returns to First Degree Relative to A level by Welsh Unitary Authority (UA Baseline)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Blaenau Gwent	.43022***	2.70	1	14	.22495	1.02	-	10
Bridgend	.20368**	2.18	11	49	.14855	1.38	-	61
Caerphilly	.24745***	2.95	8	41	.21844**	2.34	6	46
Cardiff	.15648***	3.56	16	206	.14438***	3.36	10	214
Carmarthenshire	.27329***	3.23	6	39	.28897***	3.14	3	42
Ceredigion	.16169*	1.77	15	39	.05772	0.74	-	61
Conwy	.24881*	1.69	7	17	.21329*	1.69	7	34
Denbighshire	.29739**	2.31	5	38	-.06769	0.62	-	44
Flintshire	.19717***	2.96	12	41	.12234	1.22	-	35
Gwynedd	-.06355	0.62	-	45	.18994**	2.48	8	71
Isle of Anglesey	.1921*	1.90	13	18	.27466**	2.37	5	20
Merthyr Tydfil	.38769**	2.17	2	17	-.15248	1.28	-	23
Monmouthshire	-.01477	0.15	-	33	.17099	1.60	-	40
Neath Port Talbot	.22986**	2.57	10	29	.28134***	2.70	4	35
Newport	.17786**	2.49	14	86	.0768	1.12	-	64
Pembrokeshire	.3521***	3.42	4	39	.11803	1.16	-	38
Powys	.06102	0.64	-	36	.19338	1.57	-	43
RCT	.35424***	4.03	3	34	.38052***	4.77	1	78
Swansea	.1166*	1.75	17	83	.08727	1.31	-	104
Torfaen	.23406**	2.26	9	35	.17654*	1.85	9	42
Vale Glamorgan	.13553	1.46	-	31	.12318	1.26	-	44
Wrexham	.12668	1.08	-	39	.3242***	3.56	2	35

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by unitary authority; baseline of individuals qualified to A level, disaggregated by unitary authority; N. is the number of individuals qualified to first degree level in each unitary authority; R. is the rank of unitary authorities in order of magnitude of return to first degree; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Gwynedd, Monmouthshire, Powys, the Vale of Glamorgan and Wrexham. For women, the graduate premium is found to be insignificant in twelve of the twenty-two unitary authorities, perhaps reflecting the larger national graduate premium for men within Wales. Whilst Wrexham fails to offer much incentive for men to pursue a university education, the graduate premium for women is large at .3242. Rhondda Cynon Taff (RCT) also offers great returns to a first degree, .35424 for men and .38052 for women (which is the largest female graduate premium). The largest premium for men can be found in Blaenau Gwent (.43022). I may have expected a 'London effect' occurring with Cardiff, where the graduate premium in the Welsh capital would dwarf all other unitary authorities, but this is not found (although a significant graduate premium is found for both genders working within Cardiff). This may be due to the high earnings of A level holders living in Cardiff. As I am examining the within region graduate premiums in Wales, some of the larger premiums may be a reflection of the low A level earnings in those regions. Estimating the graduate premium for unitary authorities relative to A level holders in Wales as a whole may shed light on these results.

When using a national baseline of A level holders, the graduate premium for men living in Cardiff does increase, from .15648 to .21352 for men and .14438 to .20968 for women, although Cardiff is still only ranked 10th and 11th. This suggests that there is no 'Cardiff effect' unlike the effect seen for London. The largest graduate premium for men remains in Blaenau Gwent. The suggestion that some of the large premiums seen within unitary authorities (table 5.61) is caused by low A level earnings within these unitary authorities is supported by table 5.62. For example, Merthyr Tydfil, which had the second largest male graduate premium compared to A level holders in the same unitary authority, offers no graduate premium relative to a national baseline, and the male graduate premium in RCT falls from .35424 to .2193 when switching to a national baseline of A level holders.

Tables 5.63 and 5.64 estimate the returns to all education levels relative to persons in Cardiff with no qualifications. The poor returns to a first degree for men living in

Table 5.62

Returns to First Degree Relative to A level by Welsh Unitary Authority (National Baseline)

	Male				Female			
	Coeff.	**t stat**	**R.**	**N.**	**Coeff.**	**t stat**	**R.**	**N.**
Blaenau Gwent	.41457***	4.49	1	14	.21838**	2.17	9	10
Bridgend	.15568***	3.00	16	49	.12916***	2.78	19	61
Caerphilly	.31069***	5.45	3	41	.23165***	4.35	6	46
Cardiff	.21352***	7.50	11	206	.20968***	7.93	10	214
Carmarthenshire	.19798***	3.44	13	39	.18086***	3.42	15	42
Ceredigion	.21178***	3.70	12	39	.13564***	3.02	17	61
Conwy	.14761*	1.73	17	17	.22924***	3.84	7	34
Denbighshire	.30076***	5.22	4	38	.18999***	3.62	13	44
Flintshire	.24685***	4.43	5	41	.20323***	3.62	11	35
Gwynedd	.0058	0.11	-	45	.19127***	4.67	12	71
Isle of Anglesey	.10111	1.23	-	18	.27279***	3.69	2	20
Merthyr Tydfil	.01726	0.20	-	17	.06779	0.99	-	23
Monmouthshire	.22068***	3.60	8	33	.16998***	3.17	16	40
Neath Port Talbot	.23839***	3.62	6	29	.25838***	4.39	4	35
Newport	.19092***	4.65	15	86	.13287***	3.05	18	64
Pembrokeshire	.32229***	5.61	2	39	.05879	1.06	-	38
Powys	.12373**	2.06	18	36	.25787***	4.77	5	43
RCT	.2193***	3.57	9	34	.27068***	6.54	3	78
Swansea	.11157***	2.74	19	83	.12336***	3.38	20	104
Torfaen	.19197***	3.17	14	35	.2272***	4.39	8	42
Vale Glamorgan	.2212***	3.52	7	31	.28895***	5.59	1	44
Wrexham	.21564***	3.75	10	39	.189***	3.36	14	35

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by unitary authority; national (Wales) baseline of individuals qualified to A level; N. is the number of individuals qualified to first degree level in each unitary authority; R. is the rank of unitary authorities in order of magnitude of return to first degree; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.63

Male Returns Relative to No Qualifications in Cardiff

	None	GCSE	A Level	Higher Educ.	First Degree	Masters	PhD
Blaenau Gwent	-.03682	-.00614	-.05759	.14409	.38849**	.37093	-
	(0.56)	(0.08)	(0.76)	(1.24)	(2.00)	(1.43)	-
Bridgend	-.04935	.09102	.11156*	.15246*	.08316	.33764	.07181
	(0.86)	(1.56)	(1.66)	(1.70)	(0.63)	(1.40)	(0.22)
Caerphilly	.05045	-.03602	.12401**	.05687	.24501*	.27274	.39205
	(0.81)	(0.61)	(2.00)	(0.55)	(1.73)	(1.09)	(1.04)
Cardiff	-	.12687**	.10252*	.1559*	.2336**	.32511**	.3416
	-	(2.48)	(1.90)	(1.71)	(2.27)	(2.56)	(1.12)
Carmarthenshire	-.00689	-.06238	.17917***	.02802	.17446	.31495	-1.2835***
	(0.10)	(0.92)	(2.89)	(0.27)	(1.29)	(1.62)	(2.80)
Ceredigion	-.09881	-.1025	.11059	.12377	.20052	-.18899	-.22199
	(1.07)	(1.28)	(1.40)	(0.93)	(1.54)	(0.89)	(0.68)
Conwy	.06287	-.05143	.13121*	-.08157	-.05627	.01806	-1.6809***
	(0.60)	(0.59)	(1.74)	(0.66)	(0.31)	(0.08)	(4.11)
Denbighshire	-.11396	.03481	-.0211	-.08879	.2498**	.41786	-
	(1.48)	(0.43)	(0.27)	(0.77)	(1.98)	(1.29)	-
Flintshire	-.01517	.12327*	.26954***	.21195**	.30472**	.33512	.56544*
	(0.18)	(1.95)	(4.55)	(2.15)	(2.53)	(1.48)	(1.78)
Gwynedd	-.09267	-.11837	.08833	.0847	-.13208	.16663	.27728
	(0.98)	(1.50)	(1.35)	(0.89)	(0.86)	(0.88)	(0.67)
Isle of Anglesey	-.09294	.08945	.17804**	-.03755	.08255	-.01142	.89115***
	(0.93)	(1.04)	(2.58)	(0.24)	(0.49)	(0.04)	(2.80)
Merthyr Tydfil	-.0903	-.08898	.03368	.08445	.02589	.29371	.28981
	(1.31)	(1.05)	(0.44)	(0.72)	(0.13)	(0.54)	(0.67)
Monmouthshire	-.03928	.14407**	.16519***	.13383	.04375	.37643*	.21466
	(0.51)	(2.04)	(2.71)	(1.17)	(0.35)	(1.78)	(0.68)
Neath Port Talbot	-.08298	.05429	.15735**	.15418	.26042*	.45143*	-
	(1.21)	(0.72)	(2.55)	(1.61)	(1.64)	(1.83)	-
Newport	-.10568*	.12214*	.10809*	.29942***	.25314**	.49338**	.29413
	(1.73)	(1.70)	(1.80)	(3.26)	(2.21)	(2.06)	(1.12)
Pembrokeshire	.00473	.03987	.21453***	.14478	.40525***	.05287	-
	(0.05)	(0.52)	(3.08)	(1.37)	(3.19)	(0.29)	-
Powys	-.15638*	.03462	.08017	-.01641	.0889	.15732	.0202
	(1.66)	(0.50)	(1.14)	(0.12)	(0.64)	(0.59)	(0.07)
RCT	-.03836	.07023	.10507*	.24336***	.24416	.17499	.57297**
	(0.72)	(1.14)	(1.75)	(2.70)	(1.38)	(0.83)	(2.05)
Swansea	-.00932	.03371	.07535	-.08896	.11656	.20857	.42998
	(0.13)	(0.49)	(1.26)	(1.05)	(0.93)	(1.38)	(0.99)
Torfaen	-.05781	-.0084	.13968**	.06967	.20527	.2262	.72787*
	(0.84)	(0.11)	(2.02)	(0.83)	(1.53)	(0.94)	(1.85)
Vale of Glam.	-.03511	.02796	.20255**	.2234**	.29094**	.95147***	.5908*
	(0.33)	(0.26)	(2.33)	(2.43)	(2.09)	(2.71)	(1.94)
Wrexham	.01328	.01422	.16932**	.03662	.01592	.1319	.73947*
	(0.19)	(0.20)	(2.12)	(0.33)	(0.10)	(0.41)	(1.84)

Notes: coefficient reported on a dummy variable indicating highest qualification, disaggregated by unitary authority; baseline of individuals with no qualifications working in Cardiff; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.64

Female Returns relative to No Qualifications in Cardiff

	None	GCSE	A Level	Higher Educ.	First Degree	Masters	PhD
Blaenau Gwent	.03873	.04101	.08706	.27859***	.63824***	1.6222***	-
	(0.71)	(0.76)	(1.12)	(2.78)	(4.29)	(6.16)	-
Bridgend	.04519	.09448**	.05804	.20723**	.41221***	.72272***	.78554**
	(1.20)	(2.13)	(0.88)	(2.46)	(3.08)	(2.97)	(2.34)
Caerphilly	.06346	.1017**	.09898	.15341*	.46826***	.66534***	1.3775***
	(1.17)	(2.19)	(1.52)	(1.82)	(4.05)	(2.88)	(3.43)
Cardiff	-	.13772***	.17252***	.25001***	.27789***	.67303***	1.502***
	-	(3.16)	(2.85)	(3.66)	(3.89)	(5.52)	(5.53)
Carmarthenshire	-.01081	-.00433	.12309**	.25951***	.41009***	.68726***	-
	(0.25)	(0.09)	(2.10)	(3.20)	(3.76)	(3.45)	-
Ceredigion	.03023	.04087	.14772**	.28032***	.20619**	.66148***	1.9389***
	(0.40)	(0.84)	(2.17)	(3.06)	(2.45)	(5.10)	(4.70)
Conwy	.09276	.07373	.11076*	.18797***	.30886**	.87546***	-
	(1.59)	(1.46)	(1.77)	(2.59)	(2.40)	(4.71)	-
Denbighshire	-.03736	.15892***	.13756**	.03277	.15863	.89871***	.48987**
	(0.64)	(3.10)	(2.19)	(0.37)	(1.30)	(5.19)	(2.05)
Flintshire	.00667	.07255	.10279*	.3117***	.39418***	1.9284***	-
	(0.11)	(1.58)	(1.69)	(4.06)	(3.10)	(8.69)	-
Gwynedd	.02526	.08774**	.1373**	.34221***	.17163*	.72449***	1.3499***
	(0.46)	(2.03)	(2.35)	(4.23)	(1.93)	(4.21)	(5.03)
Isle of Anglesey	.03628	.08427	.12987*	.24867*	.36741***	-.45739	-
	(0.61)	(1.59)	(1.86)	(1.84)	(2.76)	(1.44)	-
Merthyr Tydfil	.0483	.03708	.16997***	.2441***	.07179	1.867***	-
	(0.93)	(0.69)	(2.62)	(2.75)	(0.44)	(4.11)	-
Monmouthshire	.04977	.10092*	.11524*	.2354***	.23662**	.51357***	1.7216***
	(0.83)	(1.95)	(1.70)	(2.79)	(1.98)	(3.92)	(6.94)
Neath Port Talbot	.01347	.06634	.1762**	.19418**	.24191*	1.3087***	.58943**
	(0.28)	(1.57)	(2.57)	(2.38)	(1.69)	(7.85)	(2.55)
Newport	.06101	.09838**	.10781*	.32529***	.25359**	.771***	1.8005***
	(1.14)	(2.39)	(1.90)	(4.52)	(2.27)	(2.97)	(4.70)
Pembrokeshire	.05096	.03662	.06312	.1758**	.31666**	1.4195***	-
	(1.02)	(0.78)	(1.09)	(2.44)	(2.09)	(4.79)	-
Powys	.04281	.09215**	.18747***	.22356***	.27182**	.77905***	.89453***
	(0.97)	(2.05)	(3.03)	(2.73)	(2.14)	(4.18)	(3.78)
RCT	-.00138	.09397**	.14286**	.18353*	.4214***	1.3451***	.64047***
	(0.03)	(2.22)	(2.35)	(1.66)	(4.12)	(4.83)	(3.37)
Swansea	-.0036	.07185	.14261***	.22508***	.25002**	.91515***	.31254
	(0.08)	(1.59)	(2.68)	(3.86)	(2.15)	(4.72)	(0.98)
Torfaen	.05672	.1161**	.13842**	.20945***	.43289***	1.3644***	-
	(1.39)	(2.38)	(2.33)	(2.92)	(3.56)	(5.53)	-
Vale of Glam.	.06519	.11207**	.13617*	.06142	.31513***	.48521**	-
	(1.20)	(2.18)	(1.70)	(0.71)	(3.18)	(2.28)	-
Wrexham	.02163	.10911**	.04634	.19633**	.31447***	.03425	-
	(0.44)	(2.17)	(0.69)	(2.57)	(2.89)	(0.13)	-

Notes: coefficient reported on a dummy variable indicating highest qualification, disaggregated by unitary authority; baseline of individuals with no qualifications working in Cardiff; t-statistics in parenthesis; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Cardiff can be seen in table 5.63, with many unitary authorities exceeding the Cardiff figure. Masters holders in Cardiff fare better, having the fifth largest premium compared to persons with no qualifications working in Cardiff. Due to the earnings of women with no qualifications in Cardiff, there are some very large premiums at masters level and above. Due to small sample sizes, there are some erratic results, although most are statistically significant. I also identify a group in the sample of over a thousand individuals who live in Wales but work outside Wales. These individuals enjoy a higher graduate premium than those who work within Wales, with the gap being larger for women, .19859 to .17998 for men and .24219 to .15374 for women. Over a half of graduates living in Wales, but working elsewhere work in the North West and South West, regions characterised by greater earnings (and graduate premiums) than Wales.

The graduate premium is estimated for industry sectors within Wales in table 5.65. The largest premiums are found in the energy and water (.5552), transport and communications (.24484), and manufacturing (.22717) sectors for men and the transport and communication (.27102) and public administration, education and health (.17802) sectors for women. The differences in the energy and water sector graduate premiums between Wales and the UK is especially large as the figure for men in Wales is far above that found for the UK (which was the largest graduate premium of all industry sectors, for both men and women) and the result for women is insignificant. As the public administration, education and health sector is the largest industrial sector in Wales, it is likely that the large earnings advantage in this sector is driving the graduate premium found for women in Wales (results for this sector are fairly similar to the UK as a whole). Wales has a far smaller banking, finance and insurance sector than England, and comparison of the graduate premiums in this sector reveals that workers in this industry sector in Wales enjoy less of an earnings advantage than their counterparts in the UK as a whole. This result is especially prevalent for women, as the female Welsh banking, finance and insurance graduate premium is just over half that of the UK.

Table 5.65

Returns to First Degree Relative to A level by Industry Sector (Wales Only)

	Male				Female			
	Coeff.	t stat	R.	N.	Coeff.	t stat	R.	N.
Agric. & Fishing	-	-	-		-	-	-	
Energy & Water	.5552***	3.88	1	17	-.09472	0.23	-	8
Manufacturing	.22717***	6.83	3	172	.1382**	2.26	4	53
Construction	.1718**	2.49	4	57	-.09543	0.43	-	12
Dist., Hotels & Rest.	.15325***	2.62	6	64	-.02636	0.46	-	72
Transport & Comm	.24484***	3.11	2	26	.27102*	1.82	1	14
Banking & Finance	.13536**	2.33	7	167	.09732*	1.88	5	117
Pub Admin, Educ	.16111***	5.89	5	431	.17802***	8.61	2	838
Other Services	.01281	0.17	-	72	.16824**	2.33	3	67

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by industry; national (Wales) baseline of individuals qualified to A level, disaggregated by industry; N. is the number of individuals qualified to first degree level in each industry; R. is the rank of industry sectors in order of magnitude of return to first degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Table 5.66

Returns by Public/Private Sector

	Male				Female			
	Public		Private		Public		Private	
	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat	Coeff.	t stat
First Degree	.1457***	5.40	.20222***	9.14	.16737***	7.81	.1239***	4.81
Masters	.08045**	2.18	.04972	1.13	.13287***	4.84	.13656**	2.53
PhD	.03789	0.61	.0153	0.15	-.03522	0.62	-.12384	0.72

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree, masters or PhD), disaggregated by employment sector; national (Wales) baseline of individuals qualified to A level, first degree or masters, disaggregated by employment sector; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

In Wales, the percentage of STEM graduates employed in manufacturing is 19%, as with the full UK sample. The large public sector in Wales causes the share of public administration, education and health STEM graduates to jump from 36% to 45%. This reduces the percentage of STEM graduates employed in the banking, finance and insurance sector from 25% to 17% (which would be expected given Wales' smaller banking, finance and insurance sector). Whilst this figure is less than for the whole of the UK, it is still a sizable portion of STEM graduates, suggesting that policies promoting STEM may not have the desired effect upon the Welsh (and UK) economy.[56] However, table 5.60 revealed that women in Wales who did STEM subjects at first degree level enjoyed large graduate premiums.

By comparing the graduate premium across employment sectors in Wales (table 5.66) with results for the UK as a whole, it is apparent that females in the private sector do far worse in Wales (.2081 to .1239). This confirms the result found in the previous table that the female graduate premium in Wales is driven by the public administration, health and education sector, which is primarily based in the public sector. Public sector female first degree returns for Wales are also below the UK level, although not to the extent of the private sector. At first degree level, Welsh results for men are more similar to the UK as a whole, with the private sector difference being very small. I previously found the returns to a masters degree for women working in Wales to be the second highest in the UK. Comparison with UK figures shows that both the Welsh returns in the public and private sectors are far above the figures for the UK as a whole. Men in the private sector in Wales fare poorly, as no significant masters premium is found, although the public sector masters premium is greater than the UK public sector masters premium. At PhD level, no significant return is found in Wales, regardless of gender or employment sector.

[56] The full breakdown of STEM graduates working in Wales by industry sector is available in the appendix in table 5.A7.

Table 5.67

Returns to First Degree Relative to A Level by Age Groups

	Male				Female			
	Coeff.	**t stat**	**R.**	**N.**	**Coeff.**	**t stat**	**R.**	**N.**
25 – 34	.1622***	5.46	2	355	.1021***	3.77	3	480
35 – 49	.23768***	9.19	1	423	.19138***	7.88	1	479
50 – 64	.13776***	3.77	3	231	.17315***	4.05	2	225
25 – 29	.07085*	1.70	7	181	.08656**	2.37	6	252
30 – 34	.25405***	5.74	2	174	.12383***	2.90	4	228
35 – 39	.25314***	6.17	3	167	.10849**	2.43	5	161
40 – 44	.25071***	5.26	4	136	.22755***	5.11	3	170
45 – 49	.19831***	3.87	5	120	.25226***	6.15	2	148
50 – 54	.08831*	1.75	6	118	.10349	1.52	-	115
55 – 59	.26532***	4.18	1	89	.25795***	4.23	1	89
60 – 64	-.04445	0.40	-	24	.22855	1.12	-	21

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree), disaggregated by age group; national (Wales) baseline of individuals qualified to A level, disaggregated by age group; N. is the number of individuals qualified to first degree level in each age group; R. is the rank of age groups in order of magnitude of return to first degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

The graduate premium over age groups in Wales is given in table 5.67. Focusing first on the broad age bands, in Wales there is a far greater rise from the 25 to 34 year age group to the 35 to 49 year age group than is observed for the UK as a whole. This is particularly apparent for women, where the graduate premium almost doubles between these age groups. The female 25 to 34 year graduate premium in Wales is very small compared to the UK (.1021 to .17564). The graduate premium in Wales falls in the 50 to 64 year age group, an effect not seen for men in the full UK sample. The 50 to 64 year male graduate premium in Wales is smaller than the other age bands, whereas in the UK it is the highest. This fall in the graduate premium over the 50 to 64 year age group, coupled with Wales' relatively aged population is likely to be a contributing factor to Wales' low graduate premium (and low earnings). Narrower age bands show that it is a low or insignificant graduate premium in the 50 to 54 and 60 to 64 year age groups that causes this effect. Conversely, the graduate premium in Wales actually peaks in the 55 to 59 year age group. The graduate premium for men in the 25 to 29 year age group and women under 40 in Wales is quite small compared to the UK average.

5.5 Conclusion

This chapter has examined the private pecuniary benefits to gaining a university education at both first degree and higher degree levels, using the Annual Population Survey between 2004 and 2007. I identify a graduate premium for men of .20651 and .21652 for women, a masters degree premium relative to first degree of .06713 for men and .07905 for women. I find there to be no significant effect of holding a PhD relative to a masters degree at the aggregate level, although I do observe a PhD earnings advantage for more disaggregated groups. The majority of results support the notion that women benefit more from gaining a first degree than men do, which is in line with the majority of the existing literature.

I have placed an emphasis on the variation in the graduate premium across the UK, by NUTS 1 regions. When the graduate premium is calculated relative to a national baseline of A level holders, the South Eastern regions dominate, particularly London.

However, switching to a baseline of A level holders within the same regions sees the South Eastern advantage dissipate, with the largest graduate premiums being found in Northern Ireland, the East Midlands and Scotland Much of the reduction in the magnitude of the South Eastern regions can be attributed to their high A level earnings. At masters level, the largest premiums relative to first degree are again found in London when using a national baseline, but with a regional baseline London displays one of the lowest masters degree premiums. Instead, the largest within region masters premiums are found in the West Midlands and the South West for men, and the North East and Wales for women. The PhD premium is highly dependent on work place, with the only significant within region PhD premiums found for women in the East Midlands and the South West.

I have also looked at differences in the graduate premium across subject areas. Individuals possessing degrees in medicine and dentistry enjoy the largest earnings advantage by a large margin, although this may be explained by the extra time that a person may spend obtaining a degree in this subject area (and the associated increases in human capital). Outside of medicine and dentistry, the largest graduate premiums are found in economics and law, with those holding first degrees in arts, mass communications, and history and philosophy benefitting the least relative to A level holders (although a positive first degree earnings advantage is found for all subject areas). At masters degree level, many results are found to be insignificant, with many subject areas offering no earnings advantage relative to first degree. The largest masters degree premiums are found in the veterinary and agricultural studies and business administration subject areas. A PhD premium (relative to masters) is only found for men with PhDs in physical sciences. This is likely due to high earnings at masters level along with PhD level for several subjects. Due to the great variation in the masters and PhD premiums, the choice to pursue a higher degree should be highly dependent on subject area. Quantile regression results suggest the return to first degrees increases along the earnings distribution, but the difference between quartiles is insignificant. The masters premium is also relatively stable along the earnings distribution, but for PhDs (relative to masters) a premium is only observed in the upper quartile.

The results of this chapter have shown that, despite the large number of graduates currently in the labour market, the graduate premium has persisted and remains large. The substantial graduate premiums identified mean that there are still significant financial benefits to a degree level education, even in the face of increased tuition fees, although due to the heterogeneity in the graduate premium, the size of the earnings advantage depends heavily on subject area and geographical location.

In terms of policy implications, the large premiums paid to first degrees seem to support recent decisions to increase tuition fees. That graduates still enjoy a large return to their human capital investment suggests that tuition fee increases will not make a university level education unfeasible, although it will inevitably dissuade some potential students. Work must be done using more recent data, as the recent sharp increases in unemployment amongst recent graduates may suggest that demand for graduates has now fallen behind supply. If this is the case and the graduate premium is falling, this will have policy implications, perhaps that tighter controls should be introduced on the number of students. Subsidised tuition fees in Scotland and Wales should preserve the private returns available to these students, although Wales has an issue with retaining graduates after graduation (O'Leary and Sloane, 2008). National baseline results show Wales to have the lowest graduate premium of all UK regions, which would seem to support out migration of Welsh graduates, however, this does not take into account cost of living differences. Against a regional baseline the Welsh male graduate premium ranks 9^{th} in the UK. The regional difference in the graduate premium shrinks when using a regional baseline, reducing the gains from migration. Wales offers premiums in the top three of all regions for men with degrees in medicine and dentistry, biological sciences, arts and education, and women with technologies degrees. Graduates from these subject areas may benefit from in migration to Wales. Policy makers should make it known that these subject areas are well rewarded in Wales, to entice the best graduates in these areas to migrate to Wales. The recent policy of heavily promoting STEM subjects receives mixed support in this chapter, as some STEM subjects generate large premiums (maths and computer science and engineering), but a large proportion of STEM graduates do no stay in the subject area after graduation, with a quarter employed in the banking, finance and insurance sector.

The large differences in the graduate premium between subject areas suggest that tuition fees could vary depending on subject choice. With empirical evidence showing that those with degrees in medicine and dentistry, economics and law should earn significantly more than those with degrees in subjects such as arts, this could be used to suggest that those who enrol on highly rewarded courses could pay a higher contribution to their education than those who are not expected to benefit financially to the same magnitude. Results also show that subject areas attract differing returns according to the region of employment. This may suggest that in addition to fees varying across subject areas, they could also vary within one subject area across regions, however, this may lead to 'educational arbitrage', with well informed potential students enrolling where fees are lower and then looking for employment in an area of high returns (and high fees) post graduation.

Appendix 5.A

Variable Definitions

Earnings	Gross hourly earnings of individual. Entered into model in log form
Age	Age of individual
Age^2	Square of age of individual
Part Time	Dummy variable taking a value of 1 if an individual is employed part time, 0 if full time
Public	Dummy variable taking a value of 1 if an individual is employed in the public sector, o if private sector
Job Tenure	Job tenure of individual
Health Limit	Dummy variable taking a value of 1 if an individual has an activity limiting health problem
Married	Dummy variable taking a value of 1 if an individual is married, 0 otherwise
Plant Size	Vector of dummy variables indicating size of employer. 4 categories: under 25 employees, 25 to 49 employees, 50 to 499 employees, and 500 and over employees
Ethnicity	Vector of dummy variables indicating ethnicity of individual. 6 categories: white, mixed, black, Asian, Chinese, and other.

Industry	Vector of dummy variables indicating industry sector. 9 categories: agriculture and fishing; energy and water; manufacturing; construction; distribution, hotels and restaurants; transport and communications; banking, finance and insurance; public administration, health and education; and other services
Occupation	Vector of dummy variables indicating occupation. 9 categories: managers and senior officials; professional; associate professional and technical; administrative and secretarial; skilled trades; personal services; sales and customer service; process, plant and machinery; and elementary
Qualifications	Vector of dummy variables indicating highest qualification attained. 9 categories: PhD, masters, PGCE, first degree, higher education, A level, GCSE, other, and none
Year	Vector of year dummy variables

Table 5.A1

Summary Statistics

Variable	Mean	Std Dev	Min	Max
Hourly Earnings	11.44666	6.808654	1.37	54.94
Male	0.475654	0.499408	0	1
Female	0.524347	0.499408	0	1
Age	42.54854	10.13429	25	64
Age^2	1913.082	881.7279	625	4096
Tenure	8.839224	8.681765	0	55
Part Time	0.241303	0.427875	0	1
Full Time	0.758697	0.427875	0	1
Public Sector	0.344334	0.475152	0	1
Private Sector	0.655666	0.475152	0	1
Activity Limiting Health Problem	0.101089	0.301448	0	1
Married	0.242568	0.428637	0	1
Qualifications				
PhD	0.011466	0.106466	0	1
Masters	0.038892	0.193338	0	1
PGCE	0.019976	0.139917	0	1
First Degree	0.153545	0.360513	0	1
Higher Education	0.135521	0.34228	0	1
A Level	0.247098	0.431326	0	1
GCSE	0.246104	0.430741	0	1
None	0.120481	0.325524	0	1
Plant Size				
Under 25	0.311136	0.462959	0	1
25 to 49	0.138741	0.345677	0	1
50 to 499	0.352604	0.477782	0	1
500 & Over	0.19752	0.398129	0	1
Ethnicity				
White	0.949876	0.218202	0	1
Mixed	0.004407	0.066241	0	1
Asian	0.023442	0.151304	0	1
Black	0.013146	0.113901	0	1
Chinese	0.002623	0.051146	0	1
Other	0.006506	0.080394	0	1
Industrial Sector				
Agriculture & Fishing	0.00613	0.078052	0	1
Energy & Water	0.013974	0.117385	0	1
Manufacturing	0.150574	0.357634	0	1
Construction	0.051748	0.221518	0	1
Distribution, Hotels & Restaurants	0.147837	0.354939	0	1
Transport & Communications	0.063531	0.243916	0	1
Banking, Finance & Insurance	0.146327	0.353435	0	1
Public Admin., Education & Health	0.375608	0.484281	0	1

Other Services	0.044266	0.205685	0	1
Occupation Group				
Managerial	0.160917	0.367455	0	1
Professional	0.151756	0.358785	0	1
Associate Professional & Technical	0.16149	0.367983	0	1
Administration	0.139783	0.346763	0	1
Skilled Trade	0.079785	0.270961	0	1
Personal Service	0.082402	0.274977	0	1
Sales	0.061237	0.239765	0	1
Process, Plant & Machinery	0.066774	0.249631	0	1
Elementary	0.095857	0.294395	0	1
Year				
2004	0.451407	0.497635	0	1
2005	0.183322	0.386931	0	1
2006	0.183803	0.387325	0	1
2007	0.181468	0.385406	0	1
NUTS 1 Region				
East	0.059295	0.236176	0	1
East Midlands	0.05471	0.227414	0	1
London	0.085082	0.279004	0	1
North East	0.063555	0.243958	0	1
North West	0.115805	0.319992	0	1
Northern Ireland	0.017824	0.132312	0	1
Scotland	0.150037	0.357108	0	1
South East	0.122627	0.32801	0	1
South West	0.077556	0.267473	0	1
Wales	0.09244	0.289646	0	1
West Midlands	0.074794	0.263059	0	1
Yorkshire	0.08339	0.276471	0	1
Subject of First Degree				
Medicine & Dentistry	0.00186	0.043084	0	1
Medicine Related	0.009461	0.096805	0	1
Biological Sciences	0.008439	0.091476	0	1
Veterinary & Agricultural	0.001481	0.038459	0	1
Physical Sciences	0.008115	0.089715	0	1
Maths & Computing Science	0.008877	0.093798	0	1
Engineering	0.011904	0.108456	0	1
Technologies	0.0012	0.034623	0	1
Architecture	0.003379	0.05803	0	1
Economics	0.002919	0.053952	0	1
Politics	0.001514	0.038877	0	1
Social Studies	0.008142	0.089863	0	1
Law	0.004952	0.070196	0	1
Business Administration	0.014488	0.119493	0	1
Mass Communications	0.002103	0.04581	0	1
Linguistics & Classics	0.004557	0.067355	0	1

Language & Literature	0.00279	0.052743	0	1
History & Philosophy	0.005995	0.077198	0	1
Arts	0.00732	0.085243	0	1
Education	0.00925	0.095731	0	1
Subject of Masters				
Medicine & Dentistry	0.000362	0.019028	0	1
Medicine Related	0.001892	0.043458	0	1
Biological Sciences	0.001887	0.043396	0	1
Veterinary & Agricultural	0.000465	0.021557	0	1
Physical Sciences	0.001962	0.044256	0	1
Maths & Computing Science	0.002957	0.054299	0	1
Engineering	0.002779	0.052641	0	1
Technologies	0.000303	0.017397	0	1
Architecture	0.000946	0.030744	0	1
Economics	0.000746	0.027304	0	1
Politics	0.000551	0.023476	0	1
Social Studies	0.002498	0.049914	0	1
Law	0.001108	0.033272	0	1
Business Administration	0.006406	0.079783	0	1
Mass Communications	0.001006	0.031694	0	1
Linguistics & Classics	0.001038	0.032201	0	1
Language & Literature	0.000546	0.023361	0	1
History & Philosophy	0.001665	0.040772	0	1
Arts	0.001216	0.034856	0	1
Education	0.002141	0.04622	0	1
Subject of PhD				
Medicine & Dentistry	0.000703	0.026501	0	1
Medicine Related	0.000735	0.027105	0	1
Biological Sciences	0.002341	0.048326	0	1
Veterinary & Agricultural	0.000173	0.013152	0	1
Physical Sciences	0.002368	0.048603	0	1
Maths & Computing Science	0.000676	0.025987	0	1
Engineering	0.000827	0.028748	0	1
Technologies	0.000146	0.012081	0	1
Architecture	4.32E-05	0.006576	0	1
Economics	0.000173	0.013152	0	1
Politics	8.11E-05	0.009005	0	1
Social Studies	0.000389	0.019725	0	1
Law	9.73E-05	0.009864	0	1
Business Administration	0.000211	0.014519	0	1
Mass Communications	3.78E-05	0.006152	0	1
Linguistics & Classics	0.000276	0.016602	0	1
Language & Literature	0.00013	0.01139	0	1
History & Philosophy	0.00047	0.021682	0	1
Arts	0.00013	0.01139	0	1
Education	0.000222	0.014886	0	1

Table 5.A2

Summary Statistics (Welsh Sample)

Variable	Mean	Std Dev	Min	Max
Hourly Earnings	10.15473	5.676554	1.38	54.94
Male	0.455231	0.498006	0	1
Female	0.544769	0.498006	0	1
Age	42.81116	10.10968	25	64
Age2	1934.995	881.2072	625	4096
Tenure	9.259578	8.900952	0	47
Part Time	0.256244	0.436571	0	1
Full Time	0.743756	0.436571	0	1
Public Sector	0.400422	0.489998	0	1
Private Sector	0.599578	0.489998	0	1
Activity Limiting Health Problem	0.114159	0.318013	0	1
Married	0.231768	0.421974	0	1
Qualifications				
PhD	0.00965	0.097761	0	1
Masters	0.033452	0.17982	0	1
PGCE	0.025206	0.156755	0	1
First Degree	0.128253	0.334381	0	1
Higher Education	0.141938	0.348997	0	1
A Level	0.231943	0.422085	0	1
GCSE	0.275806	0.446932	0	1
None	0.131821	0.338306	0	1
Plant Size				
Under 25	0.3468	0.475965	0	1
25 to 49	0.138755	0.345701	0	1
50 to 499	0.321785	0.467175	0	1
500 & Over	0.19266	0.3944	0	1
Ethnicity				
White	0.985436	0.119803	0	1
Mixed	0.002866	0.05346	0	1
Asian	0.004621	0.06782	0	1
Black	0.00234	0.048314	0	1
Chinese	0.001287	0.03585	0	1
Other	0.003451	0.058645	0	1
Industrial Sector				
Agriculture & Fishing	0.00468	0.068248	0	1
Energy & Water	0.013337	0.114714	0	1
Manufacturing	0.16536	0.371516	0	1
Construction	0.047672	0.213078	0	1
Distribution, Hotels & Restaurants	0.153662	0.360635	0	1
Transport & Communications	0.045566	0.208549	0	1
Banking, Finance & Insurance	0.098327	0.297765	0	1

Public Administration, Education & Health	0.425831	0.494483	0	1
Other Services	0.045566	0.208549	0	1
Occupation Group				
Managerial	0.127406	0.333437	0	1
Professional	0.134074	0.340742	0	1
Associate Professional & Technical	0.160983	0.367526	0	1
Administration	0.143434	0.350525	0	1
Skilled Trade	0.089032	0.284798	0	1
Personal Service	0.095993	0.29459	0	1
Sales	0.06575	0.247852	0	1
Process, Plant & Machinery	0.082246	0.274748	0	1
Elementary	0.101082	0.301446	0	1
Year				
2004	0.518861	0.499659	0	1
2005	0.159483	0.366137	0	1
2006	0.162056	0.368513	0	1
2007	0.1596	0.366245	0	1
Unitary Authority				
Blaenau Gwent	0.025674	0.158166	0	1
Bridgend	0.055968	0.229867	0	1
Caerphilly	0.04474	0.206737	0	1
Cardiff	0.126733	0.332683	0	1
Carmarthenshire	0.042693	0.202169	0	1
Ceredigion	0.033043	0.178754	0	1
Conwy	0.030002	0.170597	0	1
Denbighshire	0.033277	0.179364	0	1
Flintshire	0.039944	0.195833	0	1
Gwynedd	0.046143	0.209801	0	1
Isle of Anglesey	0.022574	0.148547	0	1
Merthyr Tydfil	0.023861	0.152621	0	1
Monmouthshire	0.041172	0.198694	0	1
Neath Port Talbot	0.046085	0.209674	0	1
Newport	0.066203	0.248643	0	1
Pembrokeshire	0.042342	0.201373	0	1
Powys	0.036084	0.186505	0	1
RCT	0.053921	0.225869	0	1
Swansea	0.072168	0.258773	0	1
Torfaen	0.043453	0.20388	0	1
Vale of Glamorgan	0.033394	0.179668	0	1
Wrexham	0.040529	0.197201	0	1
Subject of First Degree				
Medicine & Dentistry	0.001579	0.039707	0	1
Medicine Related	0.010176	0.100365	0	1
Biological Sciences	0.006667	0.081382	0	1
Veterinary & Agricultural	0.002222	0.047091	0	1

Physical Sciences	0.006843	0.082438	0	1
Maths & Computing Science	0.00538	0.073156	0	1
Engineering	0.009006	0.094476	0	1
Technologies	0.000994	0.031516	0	1
Architecture	0.003451	0.058641	0	1
Economics	0.002047	0.045198	0	1
Politics	0.00117	0.034181	0	1
Social Studies	0.006784	0.082088	0	1
Law	0.00386	0.06201	0	1
Business Administration	0.011229	0.105372	0	1
Mass Communications	0.000936	0.030576	0	1
Linguistics & Classics	0.003918	0.062476	0	1
Language & Literature	0.00193	0.04389	0	1
History & Philosophy	0.00579	0.075872	0	1
Arts	0.007076	0.083826	0	1
Education	0.011814	0.108049	0	1
Subject of Masters				
Medicine & Dentistry	0.000234	0.015294	0	1
Medicine Related	0.002515	0.050086	0	1
Biological Sciences	0.001755	0.041851	0	1
Veterinary & Agricultural	0.000409	0.02023	0	1
Physical Sciences	0.00193	0.04389	0	1
Maths & Computing Science	0.002456	0.049502	0	1
Engineering	0.002105	0.045838	0	1
Technologies	0.000468	0.021626	0	1
Architecture	0.001111	0.033317	0	1
Economics	0.000526	0.022937	0	1
Politics	0.000643	0.025356	0	1
Social Studies	0.002105	0.045838	0	1
Law	0.00117	0.034181	0	1
Business Administration	0.004445	0.066522	0	1
Mass Communications	0.000877	0.029606	0	1
Linguistics & Classics	0.00076	0.027564	0	1
Language & Literature	0.000234	0.015294	0	1
History & Philosophy	0.001988	0.044549	0	1
Arts	0.000994	0.031516	0	1
Education	0.002924	0.053998	0	1

Table 5.A3

Full Time / Part Time Employment by Qualification Level

	Male		Female	
	Full Time	**Part Time**	**Full Time**	**Part Time**
PhD	95.17	4.83	80.49	19.51
Masters	93.96	6.04	78.54	21.46
PGCE	92.50	7.50	73.48	26.52
First Degree	95.42	4.58	73.50	26.50
Higher Educ.	95.11	4.89	61.91	38.09
A-Level	95.89	4.11	58.37	41.63
GCSE	95.15	4.85	52.06	47.94
None	90.72	9.28	41.45	58.55

Notes: percentage of full time/part time employment by highest qualification level; expressed as percentage

Table 5.A4

Full Time / Part Time Employment by NUTS 1 Region

	Male		Female	
	Full Time	**Part Time**	**Full Time**	**Part Time**
East	94.57	5.43	55.07	44.93
East Midlands	94.38	5.62	55.79	44.21
London	95.67	4.33	72.87	27.13
North East	94.59	5.41	59.00	41.00
North West	95.13	4.87	60.69	39.31
Northern Ireland	95.55	4.45	60.81	39.19
Scotland	95.30	4.70	59.88	40.12
South East	95.00	5.00	56.47	43.53
South West	93.70	6.30	52.41	47.59
Wales	94.28	5.72	57.74	42.26
West Midlands	94.91	5.09	57.21	42.79
Yorkshire	94.69	5.31	55.23	44.77

Notes: percentage of full time/part time employment by region of workplace; expressed as percentage

Table 5.A5

Proportion of Qualifications by Gender and Region

	PhD	Masters	PGCE	First Deg.	Higher Educ.	A Level	GCSE	None
Male								
East	2.16	4.48	1.42	14.99	10.71	31.90	21.53	12.81
East Midlands	1.46	3.21	1.46	15.73	10.63	33.36	20.03	14.13
London	2.19	10.24	1.15	27.93	9.24	23.96	16.72	8.58
North East	1.04	3.12	1.25	12.97	12.12	36.62	22.13	10.75
North West	1.39	3.27	1.42	15.16	11.74	34.17	20.83	12.02
Northern Ireland	1.33	3.80	0.93	15.67	8.87	32.47	15.87	21.07
Scotland	1.38	3.81	0.99	14.27	16.38	39.50	12.82	10.85
South East	2.11	5.42	1.37	18.57	12.24	30.77	20.23	9.29
South West	1.35	4.51	1.51	16.58	13.26	33.55	21.64	7.60
Wales	1.48	3.69	1.89	13.35	13.03	32.38	21.23	12.95
West Midlands	1.20	4.05	1.37	15.00	11.70	30.63	21.93	14.12
Yorkshire	1.23	3.32	1.60	14.02	10.64	35.92	21.50	11.79
Female								
East	0.78	2.94	2.24	14.60	13.25	17.63	34.79	13.77
East Midlands	0.77	2.39	2.73	14.42	14.64	18.19	31.63	15.24
London	1.36	7.88	2.65	27.87	12.35	16.14	23.06	8.69
North East	0.65	2.32	1.88	12.86	14.68	17.88	34.89	14.84
North West	0.61	2.35	2.38	13.86	13.86	18.96	33.85	14.13
Northern Ireland	0.65	3.70	2.29	18.92	14.98	15.98	27.03	16.45
Scotland	0.68	2.84	1.96	14.30	22.56	20.07	21.57	16.02
South East	0.88	3.66	2.83	16.60	14.65	19.43	31.22	10.73
South West	0.68	2.79	3.02	14.87	15.11	20.35	33.85	9.35
Wales	0.51	3.05	3.00	12.97	15.80	16.63	34.08	13.97
West Midlands	0.47	2.84	2.46	13.97	13.95	18.39	32.50	15.42
Yorkshire	0.66	2.52	2.76	13.15	13.51	17.83	35.38	14.19

Notes: percentage of highest qualification by region of workplace; expressed as percentage

Table 5.A6

Proportion of STEM Graduates by Industry Sector

	STEM (%)	STEM and Medicine (%)
Agriculture & Fishing	0.56	0.38
Energy & Water	3.00	1.79
Manufacturing	18.71	11.68
Construction	4.17	2.52
Distribution, Hotels & Rest.	5.01	4.55
Transport & Comms.	4.10	2.67
Banking, Finance & Ins.	24.50	15.25
Pub Admin, Educ. & Health	36.43	58.66
Other Services	3.52	2.5

Notes: proportion of individuals who graduated from STEM subjects, according to industry of employment.

Table 5.A7

Proportion of STEM Graduates by Industry Sector (Wales only)

	STEM (%)	STEM and Medicine (%)
Agriculture & Fishing	0.80	0.44
Energy & Water	1.37	0.72
Manufacturing	19.13	9.92
Construction	3.87	2.04
Distribution, Hotels & Rest.	4.87	3.97
Transport & Comms.	3.30	1.76
Banking, Finance & Ins.	16.74	9.26
Pub Admin, Educ. & Health	45.44	69.35
Other Services	4.56	2.54

Notes: proportion of individuals who graduated from STEM subjects, according to industry of employment; Wales only.

Table 5.A8

Returns to First Degree Relative to A level by Industry Sector (STEM and Medicine Graduates)

	Male				Female			
	Coeff.	**t stat**	**R.**	**N.**	**Coeff.**	**t stat**	**R.**	**N.**
Agric. & Fishing	.09403	1.15	-	48	.2209	1.48	-	29
Energy & Water	.26366***	8.08	1	311	.17287**	2.07	4	51
Manufacturing	.20297***	17.73	3	1,871	.20006***	6.93	2	487
Construction	.20257***	8.57	4	438	.0457	0.54	-	70
Dist., Hotels & Rest	.18248***	8.34	5	490	.17652***	6.37	3	428
Transport & Comm	.23229***	9.33	2	411	.24266***	4.50	1	129
Banking & Finance	.10964***	7.74	6	2,275	.16435***	7.82	5	804
Pub Admin, Educ	.07553***	7.41	8	3,449	.12428***	16.41	6	8,397
Other Services	.09157**	2.52	7	288	.09455**	2.42	7	217

Notes: coeff. reports the coefficient on a dummy variable indicating highest qualification (first degree) for STEM graduates, disaggregated by industry; national baseline of individuals qualified to A level, disaggregated by industry; N. is the number of individuals qualified to first degree level in each industry; R. is the rank of industry sectors in order of magnitude of return to first degree; (-) denotes an insignificant return; significance is indicated at the 10% (*), 5% (**) and 1% (***) levels.

Chapter 6

Conclusions

6.1 Conclusions

In the introduction to this thesis I identified a set of specific research questions. I believe that, over the course of four empirical chapters, I have provided answers to these questions and have considered the policy implications that have arisen. This conclusion draws the key findings and their policy implications together, as well as considering possible extensions to the research. I considered the earnings response to unemployment in the second chapter (for Wales, using the Living in Wales survey) and the third chapter (for the UK, using the APS). This was split into two separate chapters as, besides the dataset and geographic differences, each chapter approached the subject in a different way. Regardless of differences in data, geography and methodology, all of the main results were clustered around Blanchflower and Oswald's (1994) economic law of unemployment elasticity of -.1, and were well within the bounds of the results presented by the literature in this area. Using the Living in Wales survey (with additional controls in the form of the WIMD domain scores) the focus in chapter two was on Wales only, using the unemployment rate and the claimant count rate as measures of labour market slack. The stated research aim was to test whether these two measures would produce differing results. If so, it may suggest that those who are unemployed and claim benefits placed more downward pressure on wages than those who are unemployed and don't claim benefits. At the unitary authority level of aggregation, wages were found to be more flexible when using the claimant count rate. This would suggest that those who are unemployed and claiming unemployment benefits do place greater downward pressure on wages than those who are unemployed but don't claim unemployment benefits, although the differences are relatively small (-.12391 to -.09161). Regardless of the differences in the wage responses of those who claim unemployment benefits and those who do not, it is clear that the unemployed do place downward pressure on wages. This suggests more resources should be directed towards schemes aimed at reducing unemployment, such as Jobs Growth Wales.

Chapter two also considered whether the economically inactive or the long-term unemployed (defined as those unemployed for one year or more) placed any downward pressure on wages. The effect of the long-term unemployed on wages has been tested previously in the literature (such as by Blackaby and Hunt, 1992) and tends to find that the long-term unemployed have no effect on earnings. The effect of the economically inactive on earnings is an issue that as yet has received very little attention, with this study marking an early foray into this area. Initial findings from most specifications suggest that both the long-term unemployed and the economically inactive do not place downward pressure on earnings. This result was not expected, as economic logic would suggest that as a person moves further from the labour market, their effect on earnings would decrease (to the point there would be no effect). It is possible that this result was due to some spurious regression, caused by some factor not controlled for in the model. In response to this, a vector of postcode sector level dummy variables were added to 'mop up' any regional differences unaccounted for by the regular controls (the range of control variables offered by Living in Wales are less than that of the other dataset used, the APS). With the inclusion of area dummies, the effects of both the long-term unemployed and the economically inactive were found to be insignificant. Policy implications depend on whether the effect of the long-term unemployed or the economically inactive on earnings is real or due to some other factor. If real it provides a further reason for funding to be directed towards those who have left the labour market or have been unemployed for a lengthy time (increasing their chances of leaving the labour market and becoming economically inactive). Initiatives would focus on providing those individuals with the skills needed to re-engage with the labour market and be successful in job searches.

The earnings response to unemployment was also the focus in chapter three, although this chapter expanded the analysis to the UK, using the APS. Five levels of aggregation in the unemployment rate were used (NUTS 1, NUTS 2, NUTS 3, unitary authority and TTWA), representing wage bargaining from the national to local level, to consider what effect this had on wage flexibility. The majority of wage curve studies use only one level of aggregation – this chapter tested whether this is sufficient. Unemployment elasticity was found to differ across these levels of aggregation, resulting in a U-shape, with the largest elasticities found for the NUTS 3 and unitary authority levels of aggregation. It appears that this U-shape in wage flexibility for the aggregate sample may be due to a combination of the male and female wage curves. This result, while unprecedented (and untested, to the best of my knowledge) in the wage curve literature is similar to that found by Groth and Johansson (2004) using different methodology. Groth and Johansson test the link between the level of wage bargaining centralisation and the length of contracts (used as a proxy for wage flexibility), finding wages to be most flexible over intermediate levels of wage bargaining (as opposed to centralised or de-centralised bargaining systems). This result suggests that the use of more than one level of the unemployment rate provides a more complete picture of the wage response to unemployment.

In addition to using several levels of unemployment rate aggregation, wage flexibility was estimated at several points along the wage distribution. Most studies focus solely on estimation at the mean, however, the results of this study (and previous studies that have utilised quantile regression techniques) show that wages at different points along the wage distribution respond differently to unemployment. As with the levels of unemployment rate aggregation, this suggests that focusing on one point (the mean) does not provide a full picture and that further points along the wage distribution should be estimated. Interesting results are found when combining the use of different levels of bargaining centralisation with estimation along the wage distribution. Building on the work of Buettner and Fitzenberger (1998), wages are found to be most flexible for those at the lower parts of the wage distribution when using highly aggregated unemployment rates, with the largest wage flexibility switching to the upper portions of the wage distribution as the unemployment rate becomes more disaggregated (although at TTWA level wage flexibility is fairly flat across the distribution). The addition of house prices as a control variable diminishes this effect, with the effect becoming similar across unemployment rate aggregation levels, with the largest wage flexibility for those at the lower tail of the wage distribution. It is likely that the wages of those at the lower end of the wage distribution will be more responsive to any changes in the unemployment rate; efforts should be focused to get these individuals back into employment.

Chapter three also tested differences in the wage response to unemployment over worker groups. It was found that men, private sector workers and the least educated have the most responsive wages. Therefore, policy should be aimed at targeting these groups as part of economic recovery, as this is where success in raising wage levels in most likely to occur.

Spatial inequalities in earnings, employment and economic activity were tackled in chapter four. The UK was split into 124 labour market areas (based on TTWAs) and the ability of people and place to explain spatial inequalities was measured. This was based on the methodology found in Gibbons *et al.* (2010), but expanded the analysis to also consider employment and economic activity and make use of the wide range of controls for personal characteristics that are available in the APS (Gibbons *et al.* make use of the Annual Survey of Hours and Earnings). Initial results for earnings suggested that it was the people residing in an area that explained the largest part of spatial earnings inequalities, and that the role of the labour market area itself played a relatively minor role. The model was expanded to consider the effects of people versus place in the context of employment and economic activity, in addition to earnings. Once again, individual characteristics explain far more variation in employment and economic activity than the places themselves. The major policy implication of this result is that efforts to reduce spatial inequality should not be directed at the areas themselves, but at improving the personal characteristics of those people that live in the area. The analysis moved on to consider which specific personal characteristics had the largest effect on earnings, finding that occupation can explain the largest proportion of earnings variation. Whilst it is not possible to include SOC dummies as in the earnings model (as the sample also includes unemployed and economically inactive persons) a set of National Statistics Socio-Economic Classification (NS-SEC) dummies are included instead. As a proxy for occupation, this again is the greatest determinant of whether a person is in employment or economically active. From these results, individuals must be targeted by improving their skills so they are prepared for employment in a higher occupational group, but places must also be targeted in that policy makers must work to ensure that an area's occupational profile provides jobs in those occupational groups that offer the highest earnings. For this reason, future work may need to consider refinements to the model to take account of factors such as agglomeration effects (perhaps using population density controls) and to question how much of the occupational mix is due to the area (as opposed to allocating all occupation effects to people).

The final empirical chapter explored the returns to qualifications, with a particular focus on the returns to first degrees, masters degrees and doctorates. This chapter found that a graduate premium does exist, suggesting that (up until 2007, at least) the demand for graduates had managed to keep pace with the rapid increase in the supply of graduates. The premium paid to a first degree relative to A levels was slightly larger for women at .21652 compared to .20651 for men. The policy implication of this result may be that UK universities should continue producing graduates, as the results would suggest that the graduate labour market is not over saturated. However, much has changed since the end of the data period used in this study (2007). The rises in unemployment amongst recent graduates suggests that demand may now have fallen behind supply, suggesting that there may need to be a reduction in the number of graduates produced each year, perhaps closer to the level of replacement demand in graduate level occupations, with scrutiny on the areas that have graduate level skill shortages. This has policy implications, as given that a large graduate premium is found (up until at least the end of the sample period) this would support the decision to increase tuition fees, as degrees should still provide a significant premium. A premium is also found for masters degrees relative to first degrees, although this was accordingly smaller at .07905 for women and .06713 for men. No premium was found for PhDs relative to masters degrees at the aggregate level (although disaggregations did reveal evidence of PhD premiums in specific areas).

At the subject area level, there was significant variation in returns. A PhD premium (relative to masters degrees) was found, for men who studied physical sciences. There was much variation in the masters degree premium across subject areas, with twelve out of twenty subject areas failing to offer a masters premium for men and eleven for women. The largest masters premiums were found in the areas of veterinary and agricultural studies and business administration for both men and women. This large variation in returns to post graduate degrees makes it imperative that individuals are kept well informed of the returns available to them, to aid in making the correct educational choices. In terms of aiding economic recovery, there may be a case to be made that institutions should focus funding and recruitment at postgraduate level to those subject areas that do offer premiums (although this may ignore non-pecuniary social benefits that result from postgraduate knowledge in other subject areas).

Whilst there is also much variation in the first degree premium, all subject areas do offer a significant premium for both men and women. The largest premium for both, by some margin, was for those who studied medicine and dentistry, although this likely reflects the longer study time required in this subject. Outside of medicine and dentistry, the largest premiums were found in the subject areas of economics and law, whilst the smallest were found in arts and mass communications. This result may suggest that there is scope for a policy of variable fees over subject areas. As those that study subjects with a high premium would be expected to earn more, their graduate premiums would be preserved even if they paid a higher fee than those studying subjects with a low premium.

An important contribution of this paper to the literature is that it examines how the returns to qualifications vary by region, an area of research which has received relatively little attention previously, with only a few studies considering this, such as O'Leary and Sloane (2008). When calculating the graduate premium against a national baseline of A level holders, the South Eastern regions, in particular London, were found to offer the largest premiums; this result was expected due to their high levels of earnings in general. When restricting estimations to first degree and A level holders within a region, the South Eastern regions fare relatively poorly, partly due to their high earnings at A level. When the sample is restricted to those within each individual region, the largest graduate premiums for men are found in Northern Ireland and Scotland and the largest graduate premiums for women are found in the East Midlands and West Midlands. At masters degree level, the largest premiums are found in the West Midlands for men and the North East for women. Against a regional baseline, PhD premiums are only found for women in the South West and East Midlands. Whilst the differences across regions (when using this methodology) are not as large as those found by subject area, this result could be taken to mean that universities in different regions should charge different fees depending on the returns in each region. However, this may lead informed potential students to enrol in a university in a low return region, enjoying lower fees, and then graduating and looking for employment in a region of high returns (where they would have had to have paid higher fees).

The current economic climate provides plenty of scope for a continuation of the research presented in this thesis. Due to the sharp rises in unemployment experienced in recent years, it is important that research examines the earnings response over this period, in order to better understand the effects on earnings in anticipation of any future economic downturns. It is also of interest to policy makers to know which regions were affected worst in terms of earnings during the downturn and which were able to rebound fastest during the upturn. This will allow policy makers to identify those regions which are resilient and those regions that will require additional assistance in the recovery process. In addition, further exploration of the effect of economic inactivity on earnings should be undertaken. This study represents a starting point for research in this area and the methodology should be refined in order to more accurately quantify the effect of inactivity on earnings. Also, the effects of using more than one level of disaggregation of the unemployment rate in wage curve studies warrants further examination, as results presented in this thesis suggest that there are significant differences in results between different aggregation levels.

The economic downturn, combined with the overhaul of the university funding system and rises in graduate unemployment means that research into the returns to qualifications is currently of utmost importance. Due to rises in tuition fees, potential students should be aware of the potential returns to a university education. Recent research by Walker and Zhu (2008) suggests that the graduate premium has fallen for the most recent cohorts. Given that more graduates are accepting employment in non-graduate occupations and that there may be downward pressure on graduate wages due to the high level of graduate unemployment, it will be very interesting to quantify any changes in the graduate premium over this period. It may also be possible to amalgamate the methodologies of chapters two, three and five and calculate the graduate wage curve over this period using regional graduate unemployment rates and controls for subject choice. Given that chapter four expanded the analysis of people versus place from earnings to encompass employment and economic activity, it would be of interest to do the same for chapter five, testing the effects of holding particular qualifications on the likelihood of being employed or economically active. As in chapter five this could consider the differences by region and subject area. Given the trends in unemployment amongst recent graduates, this type of study would be of particular interest to policy makers.

The current economic climate also provides an impetus to continue with work on the determinants of spatial inequalities. With the possibility of regional public sector pay being introduced, the inequalities between prosperous and less prosperous regions may increase. The methodology used in chapter four must be expanded to consider the role (if any) that place has in determining occupational structure, given that this is the key determinant for earnings, employment and economic activity.

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